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KING'S

AMERICAN DISPENSATORY

BY

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MEDICINES OF NORTH AMERICA; A STUDY IN PHARMACY;
ETIDORHPA, ETC., ETC., ETC.

ENTIRELY REWRITTEN AND ENLARGED.

NINETEENTH EDITION. THIRD REVISION.

IN TWO VOLUMES.

VOL. I.

CINCINNATI:
THE OHIO VALLEY COMPANY,
317—321 RACE STREET.
1905

AUTHORIZATION.

Resolution passed by the National Eclectic Medical Association at the annual meeting, in Cleveland, Ohio, June 19, 1879:

Resolved, That this Association adopt THE AMERICAN DISPENSATORY as its STANDARD AUTHORITY.

ALEXANDER WILDER, M. D., *Secretary*.

"AUTHORITY to use for comment the *Pharmacopœia of the United States of America* (1890), Seventh Decennial Revision, has been granted by the Committee of Revision and Publication."

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PREFACE.

When the undersigned, in 1880, promised his venerable friend, Prof. King, to revise the pharmaceutical and chemical sections of the American Dispensatory if it became necessary, he did not underrate the magnitude of the undertaking, and when the publishers finally decided to issue the new edition he approached the task with apprehension. It soon became evident that the work was even greater than he had anticipated, and that the pharmacy and chemistry of the book could not be revised, but must be rewritten. In consequence, in addition to his own labors, almost the entire time of Dr. Sigmund Waldbott, Librarian of the Lloyd Library, has for a long period been devoted to bibliographical research. Had it not been for the care and patience of this gentleman and the books of reference at his command, the efforts of the undersigned would have been sadly ineffectual especially in the matter of foreign chemical and historical data. The writer can not forbear adding that monetary considerations could not have induced him to undertake this enterprise, and that no material return whatever accrues to him from this publication. The exacting researches necessary have been undertaken on his part altogether as a work of love, his uttermost desire being to fulfil his promise and to credit the memory of Prof. King. If these objects have been attained, and the pharmaceutical and medical professions are also benefited by his efforts, he will be amply repaid.

J. U. L.

In addition to the entire medical section of this work, the undersigned has undertaken the portion embracing botany, botanical history, and botanical description. Most of the material pertaining to the older Eclectic practice, found in former editions of this work, has been properly credited and retained. Many of the personal statements, and all of the uses, ascribed to special formulæ of the late author, Prof. John King, M. D., have been retained intact; in a few cases, where personality demanded, his initial (K.), or the full name (John King), have been appended. The aim, however, has been to modernize the therapy of the book, and with this object special pains have been taken, whenever possible, to give fully and clearly the specific indications and uses of each remedy. A dispensatory must of necessity be largely a compilation. The uses of a remedy that is not approved by the compiler, but which is indorsed by many physicians, may consequently demand recognition which might properly be excluded from a work on materia medica intended to voice only the author's experience. The aim has been to avoid commending excessive doses, though, in order to conform to the views of some authorities, large doses of some remedies have been recorded. This is especially true of many compounds used according to old-style practice.

The influx of a large number of new remedies, synthetic or otherwise, has necessitated reference to some of their reputed therapeútic properties. We have therefore ascribed to them such values as have been reported by physicians through periodicals, pamphlets, and other works. In this connection it may be stated that we have not neglected to record the uses of many semi-professional proprietary compounds and the patented chemicals now in considerable favor with many physicians, especially of the regular school. Concerning these remedies, our remarks, however, have been necessarily very conservative.

Liberal use has been made of the various Eclectic Journals, State and National Transactions, and Eclectic Annuals. We have drawn freely from Webster's *Dynamical Therapeutics;* Scudder's *Specific Medication, Specific Diagnosis, and Diseases of Children;* Locke's *Syllabus of Materia Medica and Therapeutics* (Felter); and Watkins' *Compendium of the Practice of Medicine.* We also wish to acknowledge our especial obligations to the editorials of Prof. Bloyer, in the *Eclectic Medical Journal* and the *Eclectic Medical Gleaner;* the contributions of Profs. Freeman, Thomas, and Wintermute; the editorials of Prof. Ellingwood in the *Chicago Medical Times,* and the contributions of Prof. Fearn and others in the *California Medical Journal.* To these and all others who have directly and indirectly assisted in the therapy of the book, the writer herewith extends his sincere thanks. H. W. F.

ACKNOWLEDGMENTS.

The authors of the present revision of King's American Dispensatory take pleasure in extending the following especial acknowledgments and thanks:

To the Committee of Revision and Publication of the *Pharmacopœia of the United States,* for permission (through Dr. Charles Rice) to use the *United States Pharmacopœia* for comment; to the Council of the American Pharmaceutical Association (through Messrs. W. S. Thompson and G. W. Kennedy) for permission to use formulæ of the *National Formulary;* to Messrs. Fritzsche Bros. for the use of Powers' *Essential Oils* and Schimmel's *Reports;* to Prof. Attfield (Chairman of Committee), for permission to abstract from the *British Pharmacopœia;* to Mr. Curtis G. Lloyd, for permission to use article on Coffee. For illustrative cuts credit is due William Wood & Co. (Johnson's *Medical Botany of North America*); Messrs. Parke, Davis & Co. (*Pharmacology of the Newer Materia Medica*); D. Appleton & Co. (*American Cyclopædia*); Messrs. Eli Lilly & Co. (Lilly's *Bulletin*); Messrs. Funk & Wagnalls (*Standard Dictionary*); Messrs. Johnson & Johnson (*Belladonna,* by Dr. F. B. Kilmer); Messrs. Frederick Stearns & Co. (*Illustrated Catalogue*); Dr. John King Scudder (*Eclectic Medical Journal*); J. U. and C. G. Lloyd (*Drugs and Medicines of North America*), and Messrs. Boericke & Tafel and Dr. Charles F. Millspaugh (Millspaugh's *American Medicinal Plants*). With deep appreciation do we recall the cordial manner in which the late Prof. Flückiger extended the privilege of his publications, a favor we gladly accepted and freely used. It would be impractical to attempt to mention herein all the journals and standard works, both foreign and American, that have been consulted in the preparation of this publication; these when drawn from are especially credited in the text, but we can not forbear naming a few to which we are especially indebted:

Prof. S. P. Sadtler, *Handbook of Industrial Organic Chemistry.*
Husemann & Hilger, *Pflanzenstoffe*, etc.
Prof. Henry Trimble, *The Tannins.*
The American and English Pharmaceutical Journals.
Archiv der Pharmacie.
Jahresbericht der Pharmacie (Beckurts).
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ABBREVIATIONS.

Endeavor has been made to extend full credit in the text by means of abbreviations, most of which are self-explanatory. The following selective list may assist some readers:

A. J. P., American Journal of Pharmacy.
A. P. A., American Pharmaceutical Association.
A. P. A. Proc., American Pharmaceutical Association Proceedings.
Am. Hom. Pharm., American Homœopathic Pharmacopœia.
Amer. Hom., American Homœopathist.
Amer. Med. Plants, Millspaugh's American Medicinal Plants.
Ann. de Chim. et Pharm., Annales de Chimie et de Pharmacie.
Ann. der Chem. und Pharm., Annalen der Chemie und Pharmacie (Liebig's Annalen).
Arch. der Pharm., Archiv der Pharmacie.
Attfield, Attfield's Chemistry.
Av., Avoirdupois.
B., Bigelow's Vegetable Materia Medica and American Medical Botany.
B. A. A. S., British Association for the Advancement of Science.
Bar., Barton's Vegetable Materia Medica of the United States.
Ber. d. d. Chem. Ges., Berichte der Deutschen Chemischen Gesellschaft.
Bot. Reg., Botanical Register.
Br., British Pharmacopœia.
Br. Phar., British Pharmacopœia.
Buchner's Rep., Buchner's Repertorium für die Pharmacie.
Buchner's Neues Repert., Buchner's Neues Repertorium für Pharmacie.
C., Christison's Dispensatory.
°*C.*, Degree Centigrade.
Cc., Cubic Centimeter.
Cm., Centimeter.
Chem. Centralbl., Chemisches Centralblatt.
Chem. Ztg., Chemiker Zeitung.
Coblentz, Coblentz's Newer Remedies.
Com. Dict. of Inorganic Solubilities, A. M. Comey, Dictionary of Inorganic Solubilities, 1896.
Compt. Rend., Comptes Rendus.
Coxe, Coxe's Dispensatory.
D., David Don, Linnæan Transactions and Philosophical Magazine.
D. and M. of N. A., Lloyd's Drugs and Medicines of North America.
Dub., Dublin Pharmacopœia.
Dymock, Dymock's Vegetable Materia Medica of Western India.
E. & V., Edwards and Vavasseur, Manual of Materia Medica, tr. by Tongo and Durand.
Ed., Edinburgh Dispensatory.
Ed. Med. Jour., Edinburgh Medical Journal.
Ed. Duncan, Duncan's Edinburgh Dispensatory, 1830.
Ed. E. M. J., Editorial, Eclectic Medical Journal.
°*F.*, Degree Fahrenheit.
F. Sylv., Michaux's North American Sylva.
Foltz, Dr. Kent O. Foltz in Webster's Dynamical Therapeutics.
G., Gray's Botany of the Northern States.
Gm., Gramme.
Gen., Genesis (Bible).
Ger. Pharm., German Pharmacopœia.
Imp., Imperial measure.
Jahresb. der Pharm., Jahresbericht der Pharmacie.
Jour. de Chim. Méd., Journal de Chimie Médicale de Pharmacie et de Toxicologie.
Jour. de Pharm., Journal de Pharmacie et de Chimie.
K., Prof. John King, M. D.
L., Lindley's Medical Flora.
Lieb. Annal., Liebig's Annalen (Ann. d. Chem. and Pharm.).
Locke, Locke's Syllabus of Materia Medica and Therapeutics. By Felter.
Lond., London Pharmacopœia.
Lond. Disp., Thomson's London Dispensatory.
Man. of Bot., Eaton's Manual of Botany.

Mat. Med. Western India, Dymock's Vegetable Materia Medica of Western India.
Matt., Matthew (Bible).
Med. Flora, Rafinesque's Medical Flora.
Mm., Millimeter.
N. F., National Formulary.
Nat. Form., National Formulary.
Nat. Ord., Natural Order.
P., Pareira's Materia Medica and Therapeutics.
P. J. Tr., Pharmaceutical Journal and Transactions (British).
P. J. Proc., Pharmaceutical Journal and Proceedings.
Par. Cod., Parisian Codex.
Pharm. 1880, United States Pharmacopœia of 1880.
Pharm. Centralh., Pharmaceutische Centralhalle.
Pharm. India, Pharmacopœia of India.
Pharm. Jour., Pharmaceutical Journal and Transactions (British).
Phil. Trans., Philosophical Transactions.
R., Rafinesque's Medical Flora.
R. & S., Roscoe and Schorlemmer's Treatise on Chemistry.
Spec. Diag., Scudder's Specific Diagnosis.
Spec. Med., Scudder's Specific Medication.
Syllab. of Mat. Med., Locke's Syllabus of Eclectic Materia Medica and Therapeutics. By Felter.
Sylva, Michaux's North American Sylva.
T., Thomson's Chemistry of Organic Bodies and Inorganic Chemistry.
T. S., Pharmacopœial Test Solution.
Taylor, Taylor's Medical Jurisprudence.
U. S., United States.
U. S. P., United States Pharmacopœia.
V. S., Pharmacopœial Volumetric Solution.
Var., variety (botany).
W., Wood's Class Book of Botany.
Webster, Webster's Dynamical Therapeutics.
Witt., Wittstein's Practical Pharmaceutical Chemistry and Wittstein's Organic Constituents of Plants.
Wo., Woodville's Medical Botany.

THE
AMERICAN DISPENSATORY.

ABIES CANADENSIS.—HEMLOCK SPRUCE.

The bark and the prepared resinous exudate of the *Abies canadensis*, Michaux. (*Pinus canadensis*, Linné; *Picea canadensis*, Link; *Tsuga canadensis*, Carrière).

Nat. Ord.—Coniferæ.

COMMON NAMES.—*Hemlock*, *Hemlock spruce.*

Botanical Source.—This common forest tree seldom rises above 75 feet, with the trunk large in proportion, straight, and covered with a rough bark. The branches are brittle and nearly horizontal, with pubescent twigs. The leaves are about half an inch in length, linear, obscurely fine-toothed, glaucous beneath, in two opposite rows. The cones or strobiles are very small, ovoid, terminal, and drooping, with a few rounded, entire scales. The foliage of this tree is delicate, bright-green above and silvery-white underneath; its timber is very coarse-grained—(G. W.).

History and Chemical Composition.—The Hemlock spruce is a well-known indigenous tree, abounding in the forests of the Northern States and Canada. The tree is found in the same latitudes and elevations as the *A. balsamea*. It flowers in May. The juice or oleoresin, known as *Canada pitch*, or incorrectly as *Gum hemlock* (for a description of which see *Pix Canadensis*), oozes from the tree, without any incisions being made, and concretes upon its external surface; the bark is removed from the tree, cut into large fragments, and boiled in water. As the resin ascends to float upon the water, it is removed by skimming and thrown into cold water. It is then placed in a coarse linen bag, and boiled a second time, to remove its impurities—(*Jour. Phil. Col. Pharm.*, Vol. II, p. 20).

It is also collected by cutting into the live tree small cotyloid depressions, into which the oleoresin exudes and from which it may be easily collected. The bark contains a large amount of tannic acid, and on this account is extensively employed by tanners, who also use an aqueous extract of the bark known as "*extract of hemlock bark.*" It contains also a volatile oil, known commercially as *oil of hemlock* or *oil of spruce*, which may be obtained by boiling the boughs in water. This oil from the leaves, known also as *pine-needle oil*, has, according to Schimmel & Co. (*Semi-Annual Report*, Oct., 1893), a specific gravity of 0.907 at 15° C. (59° F.), and an optical rotation of —20° 54′; and its known constituents are *pinene*, *bornyl acetate*, and *cadinene*. Two preparations now largely used are *Kennedy's White Pinus Canadensis* and *Kennedy's Concentrated Extract of Pinus Canadensis*. The latter is red, and is used both externally and internally; the former is white, does not stain, contains alum and zinc sulphate, and is designed for external use only.

Action, Medical Uses, and Dosage.—A strong decoction of the bark of this tree is beneficial in *leucorrhœa*, *prolapsus uteri*, *prolapsus ani*, *diarrhœa*, etc., administered internally, and used in enema; it is likewise of service as a local application in *gangrene*, and in *aphthous*, and other *oral ulcerations*.

The essential oil of this tree, the oil of hemlock, has occasionally been used by pregnant females to cause miscarriage, but serious effects are apt to follow therefrom. As a liniment this oil has been used in *croup*, *rheumatism*, and other affections requiring a stimulating local application. The essence (oil) of hemlock is diuretic and highly stimulant. Dr. W. K. Everson states it to be a superior remedy in gastric irritation to allay vomiting in *cholera morbus*, etc. The dose is 5 or 10 drops in water, every 10 or 20 minutes, until relief is afforded.

The alcoholic preparations of this drug usually pass under the name of *Pinus canadensis.* Such preparations are of much value where a mild stimulant and astringent is required, and especially in *catarrhal disorders* of the mucous tissues, with marked pallidity and relaxation. It is likewise of value in *passive hemorrhages*, and is useful topically in *scalds* and *burns*. Tincture, 5 to 30 drops; specific *Pinus canadensis*, 2 to 10 drops, preferably in equal parts of water and glycerin; the oil, 2 to 5 drops.

Specific Indications and Uses.—General asthenic state, with feeble digestion, vascular weakness, and pale mucous membranes; broncho-pulmonary irritation, with profuse secretions; coughs and colds; renal torpor; pyrosis and gastric irritation, with vomiting and diarrhœa; some cutaneous affections. Never to be used in inflammatory or sthenic conditions.

ABIES NIGRA.—BLACK SPRUCE.

The branches of the *Abies nigra*, Michaux, and the essence obtained from the same.

Nat. Ord.—Coniferæ.

Common Names.—*Black spruce, Double spruce.*

Botanical Source and History.—This tree grows in the northern parts of this continent, and in elevated situations in the Middle States, especially in the woods of mountainous districts. It is a pyramidal tree and attains the height of from 40 to 80 feet, having short, erect, rigid, very dark-green leaves. The cones are 1 or 2 inches long, ovate, reddish-brown in color, with their scales rounded, entire, wavy, and toothed at the apex.

Action and Medical Uses.—An aqueous decoction of the young branches, strained and concentrated, forms the well-known Essence of Spruce, which enters into the formation of Spruce Beer, an agreeable and salutary summer beverage, possessing diuretic and anti-scorbutic properties, and valuable on board ships. Spruce Beer may be made as follows: Take of ginger, sassafras bark, and guaiacum shavings, each, 2 ounces; hops, 4 ounces; essence of spruce, 10 ounces; water, 4 gallons; mix them and boil for 10 or 15 minutes, then strain. Add 10 gallons of warm water, 3 quarts of molasses, and 12 fluid ounces of yeast, and allow it to ferment. While fermentation is going on, put the fluid in strong bottles and cork them well.

Essence of Spruce is a viscid, molasses-like liquid, having a somewhat sour and bitterish, astringent taste.

ABRUS.—ABRUS.

The seeds and root of the *Abrus precatorius*, Linné.

Nat. Ord.—Leguminosæ.

Common Names.—*Wild liquorice, Indian liquorice, Jequirity.*

Illustration: Bentley and Trimen, *Med. Plants*, 77.

Botanical Source.—A twining shrub, bearing rose-colored papilionaceous flowers, clustered in long, one-sided racemes. The shrub attains a height of from 10 to 15 feet. The leaves are compound, abruptly pinnate, borne on a short petiole, and are divided into from 20 to 30 linear or oblong leaflets of a pale-green color, glabrous, entire and obtuse. The fruit is a long, oblong, rhomboid legume, containing from 4 to 6 seeds. The pod is a little over an inch in length, and terminates in a short beak.

History.—In India the root is official as a substitute for liquorice root, though Dymock (*Mat. Med. Western India*) denies the statement made by Ainslie and others that the root exactly coincides with that of common liquorice, and that it is sold for that drug in the Bengal bazaars. He states that the root bears but little resemblance to the liquorice root, but that the leaves are sweeter and may yield a fairly good extract. He further says that true liquorice root can be so easily collected and is so abundant as an article of commerce in Bombay that the substitution of abrus for that drug would be both inexpedient and expensive. This plant is known in Bengal as *gunj*, *gunja*, *goontch*, *kunch*, and *gurgonje*, and is called *ratti* in Hindustan. Though varying slightly in weight, the seeds are used by the Indian goldsmiths as standard weights, 1 *gunja* being equal to about 1.84 gr. Troy. According to Dutt a *gunja* is equal to 2 grains of wheat, 3 of barley, 4 of rice, or 18 mustard seeds. Abrus seeds are the agents by which the Chamâr or "Native Skinner" caste of India carry on the felonious poisoning of cattle for the purpose of securing their hides. This is done by means of small spikes, called *sui* (needles) or *sutari* (awls), which are prepared by soaking the awl in a thin paste of the water-soaked, pounded seeds, and then drying the weapon in the sun, after which it is oiled and sharpened upon stone, affixed in a handle, and then used to puncture the skin of the animal.

Abrus has been used for centuries by the Hindus, who employ the seeds as an external application in skin affections, ulcers, and to excite artificial inflammation in fistulæ. Sanskrit authors mention both the white and red seeds, and describe the root as an emetic. Mahometan writers speak of its aphrodisiac qualities. As early as 1592 Alpinus found the Egyptians using the seeds for beads, and occasionally eating them, though they considered them unwholesome as food. It is asserted that Indian singers chew the leaves of the white-seeded variety for the cure of hoarseness. The seeds, under the native name of *jequiriti* or *quequiri*, were introduced into modern medicine from Brazil, where they have long been in use among the natives as a remedy for pannus and trachoma. The shrub is indigenous to India and Brazil, and is naturalized largely throughout the tropics. The drug was introduced into England in 1862, where it excited but little attention until revived by DeWecker in 1882.

Description—SEMEN ABRI.—Crab's eye, Prayer beads, Jumble beads. Jequirity seeds are about one-fifth inch long, subspherical, hard, and of a glossy-scarlet color, with the exception of a black spot surrounding the hilum. They have a taste somewhat resembling common beans and are without odor. Dymock mentions white, purple, yellow, and blue seeds, of which only the white is common.

RADIX ABRI.—The root is twisted, long, and cylindrical, varying from ¼ to 1 inch in thickness; reddish-brown externally, the internal or woody portion being yellowish. It is porous and breaks with a short, fibrous fracture. The bark is thin. The root has but little odor, that being somewhat disagreeable at first, but is bitter and acrid to the taste, afterward slightly sweetish, resembling, to a slight extent, that of common liquorice root.

Chemical Composition.—According to Berzelius, a substance closely resembling *glycyrrhizin* may be obtained from the leaves and branches. The root contains both this principle and sugar. By treating the seeds with boiling alcohol Warden (1882) obtained an inert, white, crystalline body, slightly soluble in cold water, which has been named *abric acid* ($C_{12}H_{24}N_3O$). A mixture of proteid principles, of a light slate color, called *abrin*, was also obtained by Warden, of Calcutta, which, according to Buffalini (1886), is a violent cardiac poison. This body is found also in the root and stems. Rigaud and Dusart (1883) succeeded in getting an alkaloid from the seeds (thought, however, to be a decomposition product), which contain also a fixed oil, lecithin, and cholesterin. No irritating principle has yet been isolated from the seeds unless it should prove that two proteid bodies, one a paraglobulin, the other an albumose, are the active agents. According to Sattler the violent action of jequirity depends upon a "pathogenic micro-organism," developed in the infusion, which has the physiological property of vegetating upon the conjunctiva, thereby developing a ferment which is capable of producing the artificial inflammation. Warden and Waddell, however, believe the activity to be due, not to a bacillus, but to a soluble ferment embodied in *abrin*, as they have found the latter substance to be much more active than the seeds. *Abrin* is probably the same body as Bruylant's and Vinneman's (1885) *jequiritin*. Moist heat is said to render it inactive. Whatever may be the exciting agent, it is known that the infusion used must be at least a day old, as the freshly-made preparation is totally incapable of producing the purulent condition known as "jequirity ophthalmia."

Action and Medical Uses.—The seeds when taken into the stomach of man are said to be wholly inert. Large quantities of them are eaten by the Hindus to prevent fecundity. Half a seed rubbed in a little water, thrown into the thigh of a cat, caused the death of the animal in less than 24 hours (Warden). Jequirity kills the lower animals, acting somewhat like septicæmia, not unlike that produced by serpent venom. An infusion of the strength of 1 to 20 instilled into the eye of a rabbit produced a violent inflammation, resulting in complete destruction of that organ and gangrene of the lids. A false membrane was created with much œdema and corneal ulceration. The salivary glands became swollen, destructive suppuration of the maxillary glands taking place. Hypodermatically injected under the skin of animals, it produced gangrenous abscesses, and when thrown into the blood induced "virulent tonical phenomena" (Carnil and Berlioz, 1883). The infusion applied to the human eye several times a day will in a few hours produce an active conjunctival irritation, followed within 20 hours by severe inflammatory action, accompanied with such great swelling and œdema that the lids can not be voluntarily separated. This is accompanied with pain and rise of temperature. On about the third day suppuration ensues and continues copiously until about the eighth day, when it begins to subside. The whole period of action covers about two weeks, leaving the cornea somewhat hazy.

Abrus is a dangerous drug, and is employed only in eye disorders requiring the substitutive action of a violent drug inflammation to overcome the existing pathological inflammation. For this purpose it is employed in *scrofulous pannus* and *granular ophthalmia* or *trachoma*. In the latter disease it should only be used in old cases. It should, however, be very cautiously used, and only after all other means have been exhausted, for it not only provokes violent conjunctival inflammation, but is likely to destroy the corneal structures. It has been used successfully in *ulcers* and *corneal abscesses*. *Stricture of the nasal duct* has been reported by Murrell from the use of this drug. It is contraindicated, according to Dr. Kent O. Foltz (*Dynamical Therapeutics*), in *recent granular conjunctivitis* exhibiting velvety surfaces or having but slight secretion, or when there is a *corneal slough;* also in *dacro-cystitis* and *phlegmonous inflammations of the tear-passages*.

An emulsion prepared from the red hulls of 200 decorticated jequirity beans macerated in a small quantity of water for 24 hours and then triturated to a smooth paste in a mortar, adding sufficient water to make 800 grains of the finished product, was found of service by Shoemaker in the treatment of *ulcers*, *lupus*, and *epitheliomatous growths*. The emulsion was applied with a brush. Several modes of preparation of the seeds for use in ocular therapeutics are given, one of which is to rub in a mortar 9 seeds in an ounce of cold water, after which an ounce of hot water is added. Allow the solution to stand 24 hours and cool, and then filter. At Will's Eye Hospital, Philadelphia, 9 grains to the ounce are employed, with the addition of 4 grains of boric acid to prevent decomposition. Some oculists prefer to use abrus seeds in an impalpable powder.

Related Drug.—*Cassia Absus*, Linné, furnishes flattish, shining-black, ovate-oblong seeds, which have been used in India like jequirity. A plaster prepared from them is used on *wounds* and *sores* particularly of the penis. For *purulent conjunctivitis*, the seeds are prepared by enveloping them in dough and placing within an onion and baking. One grain is employed. Dr. G. Smith, of the Madras Eye Infirmary, declares it a dangerous and painful application to *granular lids* and other *ophthalmias* (Dymock).

ABSINTHIUM (U. S. P.)—ABSINTHIUM.

The flowering tops and leaves of the *Artemisia Absinthium*, Linné. (*Absinthium vulgare*, Lamarck).

Nat. Ord.—Compositæ.

Common Name.—*Wormwood.*

Illustration: Bentley and Trimen, *Med. Plants*, 156; Woodville, *Med. Bot.*, 22; Willdenow, *Sp. Plant. III.*, 1844.

Botanical Source and Description.—Wormwood is a perennial plant, sending up in the spring, from a stout rootstock, several bushy, herbaceous stems, somewhat woody at the base and from 1 to 4 feet in height. These die down as winter approaches, but the strong, woody base (above the root) remains several years, each year giving off new shoots. There are two kinds of leaves—radical and stem leaves; the former being from 6 to 8 inches long, the latter from 1 to 3 inches. The stem leaves are nearly orbicular in outline and deeply incised, giving rise to that form of leaf known botanically as bi- or tri-pinnatifid. The flowers are borne in a paniculate raceme, are tubular, hemispherical, pale-yellow or buff in color, numerous and nodding. The whole plant, except the woody portions, is covered with a whitish, silky pubescence, giving to it a beautiful silver-gray color. To the touch it is exceedingly soft and velvety. The odor is strongly aromatic, being intensified when the herb is bruised; and to the taste the plant is intensely bitter, with a persistently bitter aftertaste. Cultivation renders it milder to the taste and less disagreeable to the sense of smell. The *U. S. P.* thus describes this drug: "Leaves about 5 Cm.[1.97 in.] long, hoary, silky-pubescent, petiolate, roundish-triangular in outline; pinnately two- or three-cleft, with the segments lanceolate, the terminal one spatulate; bracts three-cleft or entire; heads numerous, about 3 Mm. [0.12 in.] long, subglobose, with numerous small, pale-yellow florets, all tubular and without pappus; odor aromatic; taste persistently bitter"—(*U. S. P.*).

History.—Wormwood is distributed throughout various parts of Europe (being plentiful in the Crimea), Siberia, and the highlands and mountainous districts of Barbary. It is found also in Newfoundland and the United States, being naturalized throughout the mountainous elevations of the New England States. It is cultivated in gardens both in this country and on the continent. In Germany it is employed as a substitute for hops in the making of *Wermuth beer*, and used by the French in preparing the liquor *absinthé*, an alcoholic cordial containing the oil of wormwood and other aromatics, as melissa, anise, marjoram and angelica, in the form either of oils or extracts. The plant should be gathered during its flowering period, which is from June to September, the best time probably being throughout July and August. The woody stalks should be rejected. The dried herb fully retains its virtues, which are imparted to both alcohol and water. Wormwood steeped in vinegar and water has long been popular among the laity as a local application for injuries.

Chemical Composition.—Braconnot (1815) found in this plant two azotized substances, one intensely bitter, the other insipid; a volatile oil, an intensely bitter resin, a green resin (probably chlorophyll), albumen, woody fibre, starch, potassium absinthate and nitrate, and *absinthic acid*, which, however, subsequently proved to be *succinic acid*. The plant also contains acetic and malic acids. The odor of wormwood is due mainly to a dark-green (sometimes yellowish or brown) oil, of an acrid taste, and possessing in a high degree the odor of the plant. It is known in commerce as *Oleum Absinthii*, or oil of wormwood. This oil consists principally of *absinthol* ($C_{10}H_{16}O$), which yields *cymene*, water, and a resinous body when heated with chloride of zinc or phosphorus pentasulphide (Wright). A larger quantity of oil is obtained from the dried than the green plant, the amount being also diminished by circumstances of growth, yielding a lesser quantity when the plant is cultivated or when grown in warm regions (Zeller). By proper means it may be obtained colorless, and should be protected from the light and the atmosphere, which impart to it a darker hue and render it somewhat syrupy and viscid. The peculiar bitterness of wormwood is due to *absinthin* ($C_{15}H_{20}O_4$, Senger, 1892), a substance isolated in an impure form by Caventou in 1828. Mein (1834) obtained it in white prismatic crystals.

Absinthin.—PREPARATION: Precipitate a decoction of *Artemisia Absinthium* with tannic acid in slight excess. Wash the precipitate in cold water and then digest with excess of litharge. Dry the mixture and exhaust the powder with boiling alcohol, filter, treat with animal charcoal, filter again and evaporate. The residue assumes a crystalline form in time. If not pure it can be obtained nearly white by dissolving in alcohol, treating with animal charcoal, filtering and evaporating again.

Action, Medical Uses, and Dosage.—Physiologically both oil of wormwood and extract of absinth act upon man as nerve depressants. Less than drachm doses produced in rabbits and dogs tremors, spasmodic muscular action of a clonic character, intoxication, and loss of sensibility. Larger doses (from 1 to 2 drachms) produced violent epileptoid seizures, in some instances resulting fatally. Small doses administered to man act as a gentle stimulant, larger doses produce headache, while still larger doses induce cerebral disturbances and clonic hysteroidal convulsions (Lancereaux). Victims of *absinthism* are subject to disturbed rest, with disagreeable dreams, awakening in the morning with sickness and vomiting. A chronic intoxication ensues that is more fearful in its effects than that resulting from the abuse of alcoholics. A conspicuous feature is the tendency to epileptoid attacks. Both physical and mental power is seriously impaired and the sexual system weakened to such an extent that virile power is lost in the male, while a premature menopause is a common result in the female. It is also said to produce a peculiar hyperæsthesia, most marked in the integument of the hypogastrium.

Absinthium possesses decided medicinal qualities, acting with considerable force upon the cerebrum and the sympathetic nervous system. It has been employed with success for the expulsion of the *intestinal parasites—ascaris vermicularis* and *lumbricoides.* Previous to the introduction of cinchona it was largely employed in *malarial intermittents,* and was at one time a popular remedy for *jaundice.* In small doses it is a stimulant tonic, improves the appetite, and is useful in atonic states of the gastro-intestinal tract, as *atonic dyspepsia,* especially when due to alcoholic excesses, in *flatulent colic,* and in *obstinate diarrhœa.* Large doses are apt to irritate the stomach and increase the action of the heart and arteries. It has been employed with good results in *amenorrhœa* and *leucorrhœa* when due to debility. It is principally used, however, as a warm fomentation for *sprains, bruises* and *local inflammations.* For this purpose it may be steeped in water, or better in vinegar and water, and applied as hot as can be borne. It has also been advised as an external application in chronic affections of the abdominal viscera, either in the form of tincture, infusion, or poultice. Its tonic properties are marked. Combined with a fixed alkaline salt, it is said to prove powerfully diuretic. The oil is narcotic. Of the infusion (℥i to Oj), 1 to 2 fluid ounces; of the oil, from 1 to 5 drops; the powder, 10 to 20 grains.

Related Species.—*A. tridentata,* Nutt.; *Sage brush.* Hab. U. S., from Rocky Mountains westward. The wild sage is deserving of notice. In the western states it is reputed by physicians to be a good emmenagogue, and is in common use by the people as a remedy for *putrid angina, arthritic rheumatism,* and *diphtheria.* The oil, mixed with olive oil to form a liniment, is largely employed by them in *erysipelas, contusions, sprains,* and *swellings* (Ed. *E. M. J.*, 1877, p. 237). According to Dr. Roberts (*E. M. J.*, 1877, p. 415) the oil is a valued remedy in *flatulent colic,* and the leaves used as a fomentation for *abscesses* promote the rapid formation of pus and impart such a healthy tone to the parts that the disease is quickly brought to a termination with the least possible destruction of tissue. An infusion is used by the Indians for *colds, headache,* and to expel *intestinal parasites* (Palmer). *A. trifida,* Nuttall, and *A. arbuscula* are dwarf species having like properties.

A. filifolia, Torrey.—Called *Southern wood* in its habitat, U. S. west of Rocky Mountains. Used by the Indians for *tumefactions* and *bruises.* Contains an essential oil valuable for liniments (Palmer).

A. Ludoviciana, Nuttall; Western *mugwort.*—N. W. U. S., from Great Lakes to Pacific Ocean and southward. The fruit of this and the next species used by the Indians as an article of food. This species in infusion is supposed to promote the growth of the hair, and is employed by the Pah Utes to facilitate *labor,* and as a remedy for *epistaxis* (Maisch, *Amer. Jour. Pharm.*, Vol. LII, p. 69).

A. Dracunculoides, Pursh.—Illinois to Pacific coast northward to British dominions, and southward to Arizona and Arkansas. Fruit used as food by the Indians. The bruised plants act as a topical irritant, and an infusion of them produces diaphoresis.

A. Drancunculus, Linné; *Tarragon.*—Cultivated in southern Europe, Tartary, and Siberia. A bitterish, aromatic. anise-odorous plant, the volatile oil of which is chiefly anethol ($C_{10}H_{12}O$).

A. Maratima var. *Stechmanniana,* Besser; *Wormseed.*—Europe and Asia. In saline soils, along seacoasts and in salty marshes. Source of Santonin (*Pharmacographia*).

A. Abrotanum, Linné; *Southern wood; Old man.*—Hab. southern Europe and western Asia. Cultivated in gardens in North America. An aromatic bitter, with the odor of lemons, and is said to contain *abrotine,* a crystallizable alkaloid (Craveri).

A. vulgaris, Linné; *Mugwort.*—Europe, northern Asia and northern Africa. Naturalized and cultivated in the United States. The root, which contains volatile oil, tannin, and an acrid resin, is used for medicinal purposes in Europe. Emmenagogue and German remedy for *hysteria* and *epilepsy.*

A. Pontica, Linné; *Roman wormwood.*—Hab. central Asia and southern Europe. Used as a substitute for common wormwood, though not esteemed so valuable.

A. frigida, Willdenow; *Sierra salvia, Mountain sage.*—Colorado. Probably contains some absinthin (F. A. Weiss, 1890).

A. Chinensis. }
A. Indica. } Source of Chinese *Moxa.*

A. Abyssinica, Olivier; *Tshuking, Zerechtit.*—Abyssinia. The bitterish, aromatic flowers contain a bitter principle, tannin, and essential oil (Dragendorff).

ABSTRACTA.—ABSTRACTS.

For a period preceding 1880, a class of compounds known as powdered solid extracts came into more or less conspicuity largely through the efforts of manufacturing pharmacists.

Powdered extracts were made by reducing an ordinary solid extract by evaporation to a concentrated condition, and then thickening the mass with a harmless powder, or the respective powdered, crude drug, and then drying the mixture, or by drying the extract intact, as necessity prompted.

The Pharmacopœial Committee of 1880, aiming to supply a class of official preparations embracing the qualities of powdered solid extracts, introduced a line of similar preparations under the name *Abstracta* or *Abstracts*.

These were made by evaporating percolates of the respective drugs, and incorporating the residue of each with enough milk-sugar to bring to a standard, in which one part of the dried mixture represented two parts of the drug.

Abstracts did not become popular, and neither replaced the commercial powdered extracts nor established themselves in the graces of the medical or the pharmaceutical professions. This failure was mostly due to the fact that the Pharmacopœia is a follower, and seemingly can not create a trade-demand if none exists. At the same time it was found that some of the formulæ were not practical; for example, as when an attempt was made to dry the oily percolate of Nux vomica. The succeeding Pharmacopœial Committee (1890) wisely dropped the list.

ACACIA (U. S. P.)—ACACIA.

"A gummy exudation from *Acacia Senegal*, Willdenow" (*U. S. P.*). The concrete juices of other species are also included under the commercial name Gum Acacia.

Nat. Ord.—Leguminosæ.

Synonyms: *Gum arabic*, *Gum acacia*, *Gum mimosa*, *Gummi mimosa*, *Gummi arabicum*.

Illustration: *Acacia Senegal*, Bentley and Trimen, *Med. Plants*, 94; *A. vera*, Willdenow, *Spec. Plant*, iv., 1805.

Botanical Source.—The trees and shrubs yielding this gum are numerous, and all have leaves of the bipinnate variety and long spikes or globular heads of flowers, generally of a yellow color. They are more or less thorny, from the fact that the stipules are often transformed into spines. They all delight in dry, sandy situations, and will often be found where other shrubs and trees can not exist.

The *Acacia Senegal* of Willdenow (*A. verek* of Guillemin and Perottet and *Mimosa Senegal* of Linné) is a moderate-sized tree, usually about 20 feet high. It has a crooked stem with a grayish bark, and is much branched, the limbs being scattered over or covered with a purplish or yellowish-green bark. The leaves are smooth and bipinnate, the pinnæ in two pairs, with a gland between them. The leaflets are oblong-linear and arranged in eight or ten pairs. The spines are sharp and in two pairs. The flowers, which are small and yellow, are densely crowded on axillary, stalked, globose heads, usually two together. The fruit is a smooth, compressed, moniliform legume, of a light-brown color, and usually about 5 inches long, containing about 6 flattish seeds.

The *Acacia vera*, Willdenow (*A. arabica* of Willdenow; *A. nilotica*, Desfontaines; *Mimosa arabica*, Roxburgh). A small, undersized tree or shrub, which occasionally, however, attains a height of about 40 feet, with a trunk from 3 to 4 feet in circumference. The thorns are stipulary, sometimes long, sometimes short, or almost wanting. The flowers are small, yellow, and in globose heads. Each flower has a five-cleft corolla and numerous, distinct stamens.

Botanical History.—The *Acacia Senegal* inhabits Africa from Senegal eastward to Egypt. It is called *Hashab*, and yields the most valuable gum, that coming from Dejara, in Kordofan, being the best product. It is known as *Hashabi* gum. The gums yielded by this species are known as the Kordofan and Senegal gums. It constitutes large forests north of the River Senegal.

Acacia vera (*A. arabica*). Near the Nile this tree is known as the *Ssant* or *Sont*, Egyptian thorn, or Egyptian gum arabic tree. It inhabits Egypt, Arabia, India, and is found abundantly as far south as Abyssinia, and westward to the regions of the Senegal. It produces an inferior brownish or reddish gum.

Jackson (*Account of Morocco, 3d ed., p.* 137) says:

"Of the trees from which gum arabic is obtained, and which inhabit the southern parts of Asia and the upper portions of Africa, the *A. arabica* is the most common. Several species are said to yield the gum, and probably contribute to supply that found in commerce, but that above-named furnishes the principal part of it. The gum flows naturally from the bark of the trees, in the form of a thick and rather frothy liquid, and speedily concretes in the sun into tears; sometimes the discharge is promoted by wounding the trunk and branches. The secretion is most abundant in dry, hot seasons, and among old stunted trees, especially after a rainy season has softened their bark, and rendered it apt to split during the succeeding hot weather. The more sickly the tree appears the more gum it yields; and the hotter the weather the more prolific it is."

Description and Tests.—The *U. S. P.* thus describes Acacia: "In roundish tears of various sizes, or broken into angular fragments, with a glass-like, sometimes iridescent fracture, opaque from numerous fissures, but transparent and nearly colorless in thin pieces; nearly inodorous; taste insipid, mucilaginous; insoluble in alcohol, but soluble in water, forming a thick, mucilaginous liquid. Acacia should be slowly but completely soluble in 2 parts of water. This solution shows an acid reaction with litmus paper, yields a gelatinous precipitate with basic lead acetate T.S., ferric chloride T.S., or concentrated solution of sodium borate, and does not reduce alkaline cupric tartrate V.S. The powder is not colored blue (absence of starch) or red (absence of dextrin) by iodine T.S."—(*U. S. P.*).

The best quality of gum arabic—that known as Kordofan gum, Turkey gum, or White Sennaar gum—is perfectly colorless, of a shining, conchoidal, vitreous fracture, opaque in mass, but transparent in small fragments, hard but pulverable, inodorous, and of a faintly sweetish and viscous taste. It is generally in tears, round or angular, and seldom larger than a hazel nut. The very pale, yellowish-white, yellowish-red, or brownish tears belong to the second quality, and may be rendered colorless by the action of sunlight, or when treated with chlorine water. The specific gravity is from 1.33 to 1.52. It almost invariably forms a white powder.

Cold or hot water dissolves its own weight of gum arabic, forming a thick mucilaginous solution, and from which the gum may be obtained by evaporation, or by precipitation with excess of alcohol; the concentrated solution may be kept much longer than the dilute, which latter, especially in warm weather, undergoes the acetous fermentation. The gum is also soluble in solutions of the pure alkalies, lime water, and dilute acids. Alcohol does not dissolve it, neither does ether or the oils. When boiled with sulphuric acid an unfermentable variety of sugar is formed; but with nitric acid it passes into mucic, malic, and finally into oxalic acid.—(*Ed.*) Treated with a solution of the neutral perchloride of iron, the mucilage of gum arabic becomes a light reddish jelly; with a solution of borax it forms a firm, colorless jelly, which is liquefied by powdered sugar; and, with a solution of sugar, it furnishes, by desiccation, a clear, hard, amorphous mass. Its decomposition is readily effected by the strong acids. The gums known as Gedda, Jiddah, and Turic gums were varieties of Kordofan gum.

Gum arabic does not deteriorate if kept dry, but its concentrated mucilage, after a long time, will become sour (acetic acid). Hot water is said to hasten this fermentation, if employed in making the mucilage. Dilute solutions of the gum become moldy. A few drops of sulphuric acid added to it—the solution being poured off from the resultant precipitate of calcium sulphate—is said to prevent this change—(*Am. Jour. Pharm.*, 1872).

Varieties—SENEGAL GUM.—This gum is one of the chief productions of the French colony of Senegal, being gathered by the Moors and negroes in the section north of the river of that name. It is gathered from November to July and shipped to Bordeaux, France, and some of it reaches America. It occurs in larger pieces than the Kordofan gum, and is often oblong or vermiform in shape. While some of it is colorless most of it is yellowish, reddish, or brownish in color. It is stated that it is sorted into several grades in America. Several species of Acacia, among them the *A. Senegal*, abounding in large forests, yield this gum. It breaks less easily, and seldom exhibits the fissures observed in the best variety, and while differing in appearance from the Egyptian gum, though being obtained, in part at least, from the same species, it does not exhibit different optical or chemical properties from those of the better variety. It was introduced by the Dutch, though its commerce is now controlled by the French.

Morocco Gum, *Mogador* or *Barbary gum.*—This gum is derived from the *A. nilotica*, Desfontaines (*A. arabica*, Willdenow), and derives its name from the port (Mogador) from which it is shipped from Morocco. It is gathered in July and August in the provinces bordering on Morocco, and in part from Timbuctoo. This gum comes in moderately large tears, occasionally worm-shaped, vitreous within, and crackles when exposed to a warm temperature. It has a nearly uniform, faintly brown, or dusky color, and is fissured externally. It dissolves completely in water.

Cape Gum.—Exudes spontaneously, from the *A. horrida*, Willdenow, or very common Doornboom tree of South African forests. It is produced as tears or fragments, of a pale-amber color. It is shipped from Cape Colony by way of the Cape of Good Hope, and is regarded as an inferior gum.

Australian Gum, *Wattle gum.*—This gum occurs in large globular, transparent tears or masses, which are hard and of a pale yellow, amber, or brown color. It dissolves completely in water, producing a mucilage which is very adhesive, and less liable than other gums to crackle when dry. Tannin from the bark is apt to be present on this gum. It is the product of several species, among them *A. pycnantha*, Bentham; *A. decurrens*, Willdenow (*A. mollisima*, Willdenow), and *A. homalophylla*, A. Cunningham, the fragrance of the latter earning for its wood the name of "violet wood."

India Gum, *East India gum.*—A gum has been introduced into commerce termed *Gum of India*, which is used for dressing cloths, etc. Being cheaper than gum arabic it is used to adulterate this gum, but it is unfit for pharmaceutical purposes. It reaches London in cases of about 535 pounds; the picking is done in France, where the whitest tears are mixed with gum arabic and gum Senegal. The method to detect this adulteration is to mix 30 grains of the suspected article with a pint of cold water, and allow the mixture to rest. In place of a homogeneous solution, a thick, transparent, tenacious magma is obtained, insoluble in a large amount of water. Though called *India gum* it all goes from Africa to Bombay, and from thence is shipped to other parts.

Suakin Gum, *Savakin gum*, *Talca* or *Talha gum.*—A very brittle gum, usually semi-pulverulent, obtained from the *A. stenocarpa*, Hochstetter, and the *A. Seyal var. fistula*, Schweinfurth. It is composed of colorless and brown gums, mixed, and is collected near the western shore of the Red Sea and delivered at the port of Suakin, from which it derives its name. It is sometimes partially insoluble, but gives a pasty magma with water.

Sennaar Gum, *Sennari gum.*—A gum resembling Kordofan gum in beauty, but less valuable, is gathered on the Blue Nile and exported by the way of Sennaar. This gum is known by the native term *Hashabi el Jesire.* It is quite common in commerce.

Mezquite Gum.—Dr. G. G. Shumard introduced to the profession a species of gum discovered in Texas and New Mexico, and which answers the purpose of gum acacia, forming a beautiful mucilage with water. It exudes spontaneously from the Mezquite tree, in a semifluid state, and hardens in a few hours, forming lumps of various sizes and colors, which whiten by exposure to sunlight, and finally become translucent and often filled with minute fissures. It is called *Gum mezquite*, *mezquit*, *muckeet*, *musquit*, etc. The tree from which it is obtained is the *Algarobia glandulosa*, Torrey and Gray (*Prosopis dulcis* of Kunth, or *P. juliflora* of DeCandolle). It is from 25 to 40 feet high.

The tree yielding this gum is also found in California and Mexico, and south to Chili and the Argentine Republic. The uses of mezquite gum are identical with those of acacia.

Hogg Gum, *Doctor gum.*—(Not *Gum Hogg*, or the East Indian *Kathira*, from *Cochlospermum Gossypium*, DeCandolle).—This gum occurs in irregular fragments or tears, sometimes transparent and reddish in color, at other times opaque. It is derived either from *Rhus Metopium*, Linné, or *Moronobea coccinea*, Aublet, possibly from both. Water only partially dissolves it.

Chagual Gum.—From *Puya lanuginosa*, Molina (*Pourretia lanuginosa*, Ruiz et Pavon). *Nat. Ord.—Bromeliaceæ.*—A Chilian product, of a thick, mucilaginous consistence and acidulous character, and but partially soluble in water. Borax does not precipitate it from solution, but precipitation may be effected with acetate of lead.

Admixtures.—Gum arabic is often adulterated with the inferior grades of gum, and in powdered form with starch or flour (which, however, will respond to the iodine test), besides fragments of dextrin. The latter may be detected by Trommer's test, which gives a precipitate of cuprous oxide upon standing.

Chemical Composition.—Gum arabic is generally accepted to be a mixture of salts of calcium, magnesium, and potassium formed by the union of these elements with *arabic acid*. The gum is chiefly composed of the calcium arabate. *Arabic acid*, known also as *gummic acid*, forms salts containing an excess of acid. It is considered identical with the *metapectic acid* of Frémy, and is obtained from a solution of the gum, acidulated with chlorhydric acid, by precipitation with alcohol. Before drying *arabic acid* is soluble in water, but after drying it becomes *metagummic acid*, and refuses to dissolve in either hot or cold water unless they be alkalinized. Both gum arabic and *arabic acid* are known as *arabin*. Continued heating with dilute sulphuric acid changes arabin into sugar, while oxidation by means of nitric acid results in the production of mucic, oxalic, saccharic, and tartaric acids. *Arabinose* ($C_{12}H_{22}O_{11}$) is produced by means of dilute sulphuric acid from those gums which yield none or but little of mucic acid.

Action, Medical Uses, and Dosage.—Gum arabic is nutritive and demulcent, and exerts a soothing influence upon irritated or inflamed mucous tissues, by shielding them from the influence of deleterious agents, atmospheric air, etc. On this account it has been used in *diarrhœa* and *dysentery*, to remove tenesmus and painful stools, in *catarrh*, *cough*, *hoarseness*, *gonorrhœa*, *ardor urinæ*, etc.—(*Coxe.*) It may be given almost *ad libitum* in powder, lozenge, or solution, alone or combined with syrups, decoctions, etc. In acute diseases, where it becomes necessary to use the lightest and most readily digested food, there is no article, probably, equal to gum arabic. It may be used for this purpose by dissolving half an ounce of the powdered gum in 5 ounces of water, and sweetening with loaf-sugar, of which a tablespoonful may be given every 2 or 3 hours; in low stages of *fever*, in *typhoid fever*, and wherever a mild stimulant is required, 1 ounce of a saturated solution of camphor in sulphuric ether may be added to the above, and administered in the same way; it is diuretic, promotes the action of the absorbents, and does not materially increase arterial action. Equal parts of pulverized alum and gum arabic form a good preparation to check hemorrhages from small cuts, wounds, etc. Externally, the application of its solution to *burns* and *scalds* has proved serviceable, repeating it until a complete coating is secured. It is likewise much used for compounding pills, lozenges, mixtures, and emulsions; also for administering insoluble substances in water, as oils, resins, balsams, camphor, musk, etc.

Mucilage of Gum Arabic.—To 4 ounces of finely pulverized gum arabic add, very gradually, a pint of boiling water, and rub the whole until perfectly blended. Dose, *ad libitum*. When gum arabic is adulterated with cherry gum, it is not easy to form a good mucilage; the *cerasin* of the cherry gum will cause it to be ropy. (For the official mucilage, see *Mucilago Acaciæ*).

Related Products.—*Flindersia maculosa*, F. von Mueller (*Elæodendron maculosum*, Lindley). *Nat. Ord.—Meleaceæ.* *Spotted tree*, *Leopard tree*. This tree of New South Wales and Queensland is known by the above names on account of its spotted bark. The leaves are greedily devoured by sheep in times of drought. This tree exudes from the stems and branches during the summer months masses as large as pigeon eggs, of a clear amber-colored gum, having a pleasant taste, and which is eaten by the aborigines, and commonly employed by the bushmen for *diarrhœa*. It forms a good adhesive mucilage, and reminds one of a good quality of East India gum acacia. About 80 per cent of *arabin*, but no metarabin has been found in it—(J. H. Maiden, *Useful Native Plants of Australia*). The gum is known as *Leopard tree gum*.

Cedar Gum.—A light-yellow gum derived from the *Red cedar* or *Cedrella Australis* of Queensland. The tears swell and subsequently dissolve in water. It contains no resin, but of arabin 68 per cent, and of metarabin 6 per cent—(*P. J. Trans.*, 1890).

ACETA.—VINEGARS.

These are official liquid medicines, formed with vinegar as a menstruum and charged by maceration with different medicinal principles. Many medicines contain active principles which are not readily taken up by water or alcohol, or are, perhaps, insoluble in them, but which are freely soluble in vinegar; others again, although soluble in water or alcohol, are not as efficient and energetic thus prepared, as when tinctured in vinegar; on this account, *medicated vinegars* are especially useful in many instances. The vinegar of commerce is very apt to contain impurities and elements which lead to its decomposition; hence, when used as a solvent for pharmaceutical purposes, distilled vinegar or diluted acetic acid should be preferred. The solvent property of vinegar chiefly depends upon its acetic acid, which renders it more especially valuable in the preparation of those agents, especially alkaloids, which are soluble in this acid, or which are rendered more soluble by being converted into acetates. Medicated vinegars are not permanent preparations; and to prevent their spoiling too rapidly, a small proportion of alcohol is usually added to them, which, however, necessarily gives rise to some acetic ether, besides being sometimes liable to cause precipitation; if the same proportion of concentrated acetic acid be substituted for the alcohol, the formation of the ether may be avoided, and the medicated vinegar be preserved equally as well. It is better to prepare this class of compounds only as they are required.

ACETANILIDUM (U. S. P.)—ACETANILID.

FORMULA: $C_6H_5NH.C_2H_3O$. MOLECULAR WEIGHT: 134.73.

"An acetyl derivative of aniline"—(*U. S. P.*).

SYNONYMS: *Phenylacetamide, Antifebrin, Antifebrinum, Acetylamidobenzene, Acetanilide.*

Source and Preparation.—Acetanilid was first made in 1852 by Gerhard. It is prepared by heating to moderate ebullition equal quantities of glacial acetic acid and pure aniline. This should be accomplished in a retort or flask furnished with a reflux condenser, and the operation continued until a small amount of the mixture cools to a solid when taken from the flask. The resulting mass is then subjected to distillation, acetic acid and water first passing over, and lastly the acetanilid, which is subsequently crystallized by treating with boiling water. It is obtained white by subliming the crude acetanilid.

Description.—The Pharmacopœia describes this comparatively new drug as follows: "White, shining, micaceous, crystalline laminæ, or a crystalline powder, odorless, having a faintly burning taste, and permanent in the air. Soluble, at 15° C. (59° F.), in 194 parts of water, and in 5 parts of alcohol; in 18 parts of boiling water, and in 0.4 part of boiling alcohol; also soluble in 18 parts of ether, and easily soluble in chloroform. When heated to 113° C. (235.4° F.), acetanilid melts. Upon ignition, it is consumed without leaving a residue. Acetanilid is neutral to litmus paper"—(*U. S. P.*).

It is also freely soluble in benzin, and sparingly so in disulphide of carbon.

Tests.—"When agitated with colorless, concentrated sulphuric acid, in a clean test-tube, acetanilid dissolves without imparting color to the liquid. On heating about 0.1 Gm. of acetanilid with a few Cc. of concentrated solution (1 in 4) of potassium or sodium hydrate, the characteristic odor of aniline becomes noticeable. On now adding chloroform, and again heating, the disagreeable odor of isonitril (which is poisonous) is evolved. On boiling 0.1 Gm. of acetanilid for several minutes with 2 Cc. of hydrochloric acid, a clear solution results which, when mixed with 3 Cc. of a 5 per cent aqueous solution of carbolic acid, and afterwards with 5 Cc. of a filtered, saturated solution of chlorinated lime (*Calx chlorata*), acquires a brownish-red color, becoming blue upon supersaturation with ammonia. A cold, saturated, aqueous solution of acetanilid, added to ferric chloride T.S., should not affect the color of the latter (absence of *aniline salts* and *various allied substances*)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—In health the effects of acetanilid are less pronounced than in febrile states. Small doses of acetanilid produce a quieting effect, and the renal and cutaneous secretions are augmented; blood-pressure is first elevated, then depressed, and cardiac action is decreased in frequency. Moderate quantities act as a vaso-motor and cerebral stimulant. Large doses produce serious symptoms, powerfully depressing the nervous system and circulatory apparatus. Weakness, slight headache, tinnitus aurium, and general malaise, and often a sense of coldness, a peculiar cyanotic hue, collapse, convulsions, and death result from its immoderate use. Whether these symptoms are due to the patient's susceptibility or to impurities in the drug has not been definitely determined. It is claimed that the reduction of temperature when fever is present is due to its action in changing oxyhæmoglobin into methæmoglobin, and its consequent interference with oxidation, which produces the cyanosis. Very large doses increase the urea and uric acid in the urine, destroy the red corpuscles, decrease the alkalinity of the blood, and impart to the urine a deep-brown color, due to the liberation of hæmoglobin from the blood. When death is produced both motor and sensory paralysis ensues, and the heart is arrested in diastole. Among other symptoms noticed from varying doses of the drug are profuse perspiration, rubeoloid eruption, anæsthesia, coma, failing respiration, and loss of reflex action. Even 5 grains have been charged with causing collapse in one case and death in another. The drug is eliminated by the kidneys, and should be avoided in all cases of fatty degeneration, particularly of the heart, kidneys, and liver. Nausea, vomiting, and diarrhœa have been attributed to this drug by some, while others deny such effects.

Acetanilid was originally introduced as a remedy for *pyrexia*, and indeed by many its chief action is asserted to be antipyretic. It has, however, fallen into discredit in many quarters on account of the dangerous collapse and cyanotic condition which it often produces. It should have no place in fevers of a low or typhoid type, and we are admonished that while excellent results have been obtained in *scarlatina*, it should be carefully watched on account of the numerous instances of drug-intoxication observed from its use in children. Very little use is made of the drug by eclectic practitioners in febrile states, the exceptions, perhaps, being in *puerperal fever*, *rheumatic fever*, uncomplicated with cardiac disorders, and in *erysipelas*, in all cases to be used only when the temperature is excessively high. It may be used to control the *hectic fever of phthisis*. Acetanilid is of considerable value in *acute inflammatory rheumatism*, especially in those cases in which salicylic acid and the salicylates are said to be admissible, but fail to do any good. Here it contributes to reduce the swelling and alleviate the pain. It should not, however, be used in this complaint for any length of time, or in large doses. It is particularly useful when the rheumatic affection is ushered in with sharp and severe pain, in which case it should be preferred to opiates. Intense pain from muscular spasm is quickly relieved by it.

Acetanilid finds more favor with us in disorders of the nervous system than in any other class of affections. It is decidedly antispasmodic and analgesic. *Asthma*, *chorea*, some cases of *epilepsy*, *whooping cough*, and *bilious colic* seem to yield to its action, while in various *headaches* of a nervous origin it appears to be of considerable value. In *migraine*, *neuralgic* and *rheumatic headaches*, *sick headache*, *reflex headache*, from uterine disorders, *facial neuralgia*, *sciatica*, neuralgias depending on changes in the spinal cord, *neuralgia of tabes dorsalis*, and the pains of *locomotor ataxia*, its beneficial results are gratifying, and it has, in some cases, supplanted morphine in these affections as a pain-reliever. Indirectly, by relieving acute and subacute pain, it acts as a hypnotic, or rather prepares the way for a refreshing sleep. It should be borne in mind that it is a dangerous drug in fatty degenerations and in dilated states of the cardiac ventricles.

Locally, acetanilid has been recommended as a topical dressing for *chancre* and *chancroid*, and as an antiseptic for *wounds*. Here we have not found it of marked value. Dose: From 2 to 10 grains, in powder, capsule, or wafer, every 1 or 2 hours, until 3 doses have been taken; if used in febrile states, every 4 hours. We believe the small dose—even 1 grain—is as effectual as the larger doses when indicated. Great care should be exercised in its use. In cases of collapse, external heat, friction, alcoholic or ethereal stimulation, with sulphuric ether, strychnine, or atropine hypodermatically should be resorted to to sustain the breathing and circulatory organs.

Specific Indications and Uses.—Acute frontal and neuralgic headaches;

diffused headache of a nervous origin; congestive and reflex headaches when not due to gastric disorders or faulty digestion; sick headache; acute pain, with high temperature, provided the heart and kidneys are in good condition. The small dose preferred.

Related Drugs.—Various drugs are now upon the market which contain acetanilid in amounts reaching as high as 90 per cent. They are most generally antipyretics and analgesics, and figure largely as "headache cures." In some of them there has been detected sodium bicarbonate, caffeine salts, bromides, salicylic acid, and the salicylates. Some of these are now largely employed by the profession, and consequently should receive our attention.

Antikamnia.—This is a proprietary drug, whose definite composition is at present unknown to the profession. It is prepared by the Antikamnia Company, of St. Louis, Mo. Pharmacists have no legal right to make any substance under that name, and physicians can not employ any other than the genuine.

Antikamnia is a white powder. It also comes in tablet form. When dissolved in water, and in the presence of diluted acids, it effervesces. It is largely used as a substitute for morphine in painful states, particularly *rheumatism*, *neuralgia*, *nervous headache*, and *dysmenorrhœa*. Dose: 2½ to 5 grains. Larger doses have been recommended, but should be used with great care.

Benzanilid, *Benzanilide*, *Phenylbenzamid(e)*, *Benzoylanilide* ($C_6H_5NH.C_7H_5O$).—This compound is the result of the interaction of aniline, and benzoic anhydride, benzoyl chloride, or benzoic acid. It crystallizes in white, pearly scales, without taste or odor. It refuses to dissolve in water, is sparingly soluble in cold alcohol (1 in 58), and more freely in boiling alcohol (1 in 7). An eruption resembling measles has followed its use, and by continued use the medicine becomes less and less effective. The uses are much the same as for acetanilid, and the dose ranges from 1 to 12 grains.

Bromacetanilid, *Acetbromanilid* ($C_6H_4BrNH.C_2H_3O$).—The para-compound of this drug is known as *antisepsin*, and should not be confused with *antiseptin* and *antiseptol*. Neither should it be mistaken for *Asepsin*, a name which has (improperly) occasionally been applied to it. Asepsin can be applied properly only to the product known also as "*nascent wintergreen*." (*See Asepsin.*) Antisepsin is produced by acting upon acetanilid with bromine, and forms colorless crystalline needles, with neither taste nor odor. It fuses at about 165° C (329° F.). In water it is practically insoluble, sparingly soluble in glycerin, but more freely in alcohol and ether. Its chemical names are *mono-* or *paramono-bromphenylacetamide*, or *paramonobromacetanilid*. This drug is reputed antiseptic, antipyretic, and analgesic, and has been employed in *pneumonitis*, *enteric fever*, *consumption*, and locally as a dressing for *wounds* and *hemorrhoids*. From ½ to 1 grain, three times a day is the usual dose.

Methylacetanilid ($C_6H_5NCH_3.C_2H_3O$), *Exalgin* or *Exalgine*.—This compound was first produced in 1874 by Mr. A. W. Hofmann. It may be prepared by slightly heating acetylchloride and monomethylaniline, and subsequent crystallization from boiling water. It may also be prepared by the interaction of sodium acetanilid and iodide of methyl. Exalgine forms small, acicular, or prismatic crystals, tasteless, odorless, and colorless. It dissolves readily in boiling water, chloroform, alcohol, and disulphide of carbon. It dissolves with difficulty in cold water (about 1 in 60 parts), and in about 1 in 10 of ether. It fuses in open air at about 100° C. (212° F.), but a couple of degrees lower when covered with water.

Its dose ranges from ½ grain to 5 grains (in diluted alcohol), though 3 grains three times a day is as high as is usually administered. It is employed for *neuralgias* and in *chorea*. It produces poisonous effects, among which are noted disturbed vision, tinnitus aurium, emesis, headache, spasmodic muscular action, jaundice, and cyanosis.

Antinervin, *Salicyl-bromanilide*, *Salbromalide*.—A proprietary drug, composed of bromoacetanilid and salicylanilid. According to Squibb, it is a mixture of ammonium bromide, and salicylic acid, of each one (1) part, and acetanilid two (2) parts. It has been recommended in *neuralgias* in doses of from 5 to 15 grains.

Phenolid and Exodyne.—Are compounds resembling antinervin in composition, the chief ingredient of which is thought to be acetanilid.

Iodantifebrin, *Iodacetanilid* ($C_6H_4INH[C_2H_3O]$).—Flake-like rhombic crystals, soluble in alcohol and glacial acetic acid, but scarcely soluble in water. Its physiological effects are slight, and it is not likely to prove of any value in therapy.

ACETONUM.—ACETONE.

Formula: C_3H_6O. Molecular Weight: 57.87.

Synonyms: *Pyroacetic ether*, *Pyroacetic spirit*, *Acetylmethylide*, *Di-methyl-Ketone*, *Æther pyroaceticus*, *Spiritus pyroaceticus*.

History and Preparation.—This substance is prepared by the dry distillation of the acetates, and other substances, such as tartaric and citric acids, and from sugar and various other carbohydrates. It is produced in large quantities as a by-product in the making of aniline. To obtain it, either barium-, lead- (4 parts with 1 of burnt lime), or calcium acetate (usually one of the latter two), is subjected to dry distillation in an earthenware retort, and treated fractionally with calcium chloride to free it from H_2O. Acetone exists in small quantities in the blood, urine, and abundantly in diabetic urine. It is asserted that the odor peculiar to persons suffering from diabetes is due to the exhalation of acetone. To this substance is charged the pulmonary complications and coma in the latter stage of this disease. It is extensively used in the manufacture of chloroform, both in the United States and abroad. For this purpose it is distilled with calcium hypochlorite and water. It is converted into iodoform when acted upon by iodine in the presence of an alkali.

Description.—Boil. pt. 58° C (136° F.); sp. gr. 0.7921 at 18° C (64.4° F.). Acetone is a limpid, colorless liquid, readily inflammable, burning with a clear, luminous flame. It is miscible with water, ether, alcohol, and volatile oils in all proportions. Its odor is agreeable, ethereal or mint-like, and its taste sharp, burning, and sweetish. It is principally valued for its property of dissolving fats, resins, gun-cotton, and camphors.

J. U. Lloyd has shown that of all the ordinary neutral solvents, acetone stands conspicuous, in that equal bulks of others capable of mixing with any proportion of water form a transparent mixture with all proportions of glycerin, while equal bulks of acetone and glycerin separate the larger share of the glycerin. Prof. Henry Trimble has shown that acetone is the best solvent for tannins, and that it may be used in many manufacturing processes. His predictions are likely to be verified in commerce.

Action, Medical Uses, and Dosage.—Acetone is soporific, intoxicating, and anthelmintic. From 15 to 20-drop doses, administered in sweet spirit of nitre, are recommended in *gout* and *rheumatic complaints*, and for the expulsion of *worms* from the intestinal tract. It was formerly employed to check the secretions and *cough* of pulmonary complaints. It is of but little use as a medicine.

Related Compounds.—ACETAL, *Di-ethyl-Acetal* ($C_6H_{14}O_2$, or $CH_3CH\,[C_2H_5O]_2$).—Molecular Weight, 117.74. Sp. gr. 831 at 20° C (68° F.); boil. pt. 104° C (219.2° F.). A colorless liquid, produced by the oxidation of alcohol through the agency of sulphuric acid and manganese dioxide, and other means. Acetal has an agreeable odor, somewhat like alcohol, and a persistent, pungent, yet refreshing, taste. It is slightly soluble in water, but dissolves freely in alcohol or ether. It must be preserved from the atmosphere and oxidizers, which change it to aldehyde, resulting finally in the formation of acetic acid.

Acetal acts upon the brain, slowly intoxicating even to insensibility. It lowers blood-pressure, thereby acting as a hypnotic. Its hypnotic effects are followed by depression, heavy sensations in the extremities, and nausea. It kills by asphyxiation. It is but little used. Its hypnotic dose is from 1 to 3 drachms.

ACETOPHENONE, *Phenylmethyl-ketone* ($C_6H_5.CO.CH_3.$), *Hypnone.*—This product was prepared in 1857 by Friedel, who obtained it by dry distillation of a mixture of acetate and benzoate of calcium. It was introduced in medicine by Dujardin-Beanmetz as *hypnone.* It is now prepared by the interaction of benzoyl chloride and zinc-methyl. It may be obtained in white plate-like crystals, but the form generally employed is *liquid hypnone.* The latter is a highly refrangent, mobile liquid, pungent and disagreeable to the taste, and possessing a mixed odor of orange and bitter almonds, which is persistent. Though non-inflammable, it adds to the inflammability of substances saturated with it. Hypnone refuses to dissolve in water, remaining therein suspended as globules. It dissolves sparingly in glycerin and freely in alcohol, chloroform, ether, benzol, and the fixed oils. It dissolves iodine and bromine with ease, and when treated with chromic acid is resolved into carbon dioxide and benzoic acid. Its density is 1.032. It becomes solid at 14° C (57.2° F.), and fuses again at 20.5° C (68° F.). A convenient form of administration is in emulsion with peppermint water or syrup, or in oleaginous solution, given in capsules. A syrup may be prepared with 1 drop of hypnone, 16 drops of alcohol, and 100 drops of syrup of orange; an elixir with 1 drop of hypnone and 50 drops each of alcohol and peppermint syrup. It is regarded as a hypnotic, possessing, in rather large doses (6 to 8 drops), a slight anodyne action. There are several objections to its use, chief among which are its tendency to produce gastric disturbance, its unpleasant taste, and the disagreeably persistent odor it imparts to the breath, besides being dangerously depressant. It is not a reliable drug for pain, nor can much be expected of it when insomnia is occasioned by nervous excitation.

ACETUM.—VINEGAR.

SYNONYMS: *Acetum britannicum* (British malt vinegar), *Acetum gallicum* (French wine vinegar), *Acetum destillatum* (distilled vinegar), *Acetum crudum.*

Source and History.—Vinegar is a dilute acetic acid, combined with foreign coloring and flavoring substances, and is prepared by the acetification of cider, malt, or wine, and by the oxidation of alcohol. It is the result of a fermentative process, known as the *acetous*, by which certain liquids or infusions undergo a change, causing them to have a manifest sourness to the taste. Those fluids which are capable of acetous fermentation possess more or less saccharine matter, as fruits, grain, etc. In order to effect an acetous fermentation a temperature is required, ranging from 21° to 35° C. (70° to 95° F.), which is accompanied with the formation of a remarkable vegetable, of a fungous and microscopic character, consisting of the mycelium of *Penicillium glaucum*, vegetating actively, and increasing by crops of *conidia* or *gemmæ*. By some this vinegar-plant has been named *Torula aceti*. During this process the alcohol of the previous vinous fermentation disappears, and its place is occupied by vinegar. According to Pasteur, this microscopic vegetation is the *Mycoderma aceti* (*Ulvina aceti*, Kützing), and that it is this agent and not the atmospheric oxidation that gives rise to the process of acetification.

Preparation and Description.—Vinegar is prepared from many substances. In France red wines are principally employed; in Britain it is made from different kinds of malt liquor, cider, saccharine fluids, etc.; and in the United States from cider and whiskey chiefly. The Germans have a quick method of making vinegar, by mixing certain proportions of alcohol, water, and honey, extract of malt or ferment, and which, by a certain process is exposed to the atmosphere by distributing it over beech-wood shavings in a large vat, that it may have an extensive surface for oxidation, and is thereby converted into vinegar in from 24 to 36 hours. Vinegar is likewise made by several other processes, some of which require a comparatively short time for its formation. The surface of vinegar is frequently covered by moldiness (*Mucor mucedo*); a small fly (*Musca cellaris*) is apt to infest it; microscopic animals, called vinegar eels (*Anguillula aceti*) are common to vinegar containing mucilage and no sulphuric acid; and, on long standing, or when kept in open vessels, a gelatinous, vegetable substance, called the "mother of vinegar" (*Mycoderma cerevisiæ*), is formed at the expense of the acid, rendering the vinegar turbid and weaker. These matters may be removed by boiling the vinegar, and then filtering it.

Good vinegar has a peculiar and grateful odor, and an agreeable sour taste. Its color depends somewhat on its mode of manufacture; when prepared from malt liquors it is yellowish-red; when from wine it is pale or deep-red, depending upon the white or red wine from which it is made; and when from cider it is pale-yellow. The high-colored vinegars may be rendered colorless by filtration through charcoal, or by distillation in a glass retort.

Adulterations and their Detection.—Crude vinegar contains a small amount of sulphates and chlorides. Consequently barium chloride, which precipitates the sulphates, is not a good testing reagent to detect free sulphuric acid in vinegar, but upon boiling the latter with calcium chloride a precipitate will show the presence of free acid, but not sulphates, in small amounts. When vinegar is free from sulphuric acid, acetate of lead has no action upon it. Copper may be detected by the addition of ammonia in excess, which renders the vinegar blue, nor should metallic copper be deposited on a clean, bright piece of iron immersed in it. Vinegar containing lead gives a yellow precipitate of iodide of lead, when iodide of potassium is added to it; when it is free from lead and copper, hydrogen sulphide causes no precipitate. When the mineral acids are present they may be detected, according to Chiappe, by producing a deep-blue coloration, with an aqueous or alcoholic solution of Paris violet (methyl-anilin-violet).

Action, Medical Uses, and Dosage.—Vinegar forms an agreeable cooling drink in *fevers*, especially when the tongue is red and coated dark or brown; it diminishes inordinate vascular action, allays thirst, neutralizes excess of alkali, and increases the urinary discharge. In *typhus*, *scurvy*, and *putrid diseases* it acts as an antiseptic. In *urinary affections*, attended with a white sediment consisting mainly of phosphate of calcium and ammoniaco-magnesian phosphate, it has been recommended. In *dysentery* and *scarlatina*, vinegar, saturated with common house-salt, has been very beneficial. A large tablespoonful of the mixture must be added to 4 of hot water, of which a tablespoonful is to be taken, as hot as may be, every 2 or 3 minutes, till the whole is consumed. A similar preparation proved very effectual in the treatment of *Asiatic cholera* in Cincinnati during 1849–50, and has likewise been found beneficial as a local application in external *inflammations*, *contusions*, severe *injuries to joints*, *swellings*, etc. The vapor of vinegar, inspired with that from hot water from a proper inhaler, is of decided service in most varieties of *laryngeal inflammation*, *tonsillitis*, *hoarseness*, *putrid sore throat*, *diphtheria*, *relaxed sore throat*, and *ulceration of the fauces;* this inhalation will also be found of great utility in dryness and irritation of the pulmonary tubes during *measles* and other *exanthematous diseases*. Diluted, it is a favorite domestic remedy for fumigating the apartments of those ill of *contagious diseases;* it does not destroy the infection, but renders the atmosphere less disagreeable. Vinegar has been used as a gargle in the same affections of the throat and fauces. It has also been applied locally in some cases of *ophthalmia*, in *epistaxis*, several *cutaneous diseases*, and diluted with water has been used as an injection into the rectum in *hemorrhoidal affections*, and into the uterus in cases of *uterine hemorrhage*. Injected into the rectum it destroys *ascarides*, and as a lotion is said to be fatal to *pediculi*. Large doses of vinegar induce diarrhœa and impair digestion; small doses, however, favor digestion by stimulating the gastric and salivary secretions and aid in softening otherwise indigestible food. Vinegar is one of the best antidotes to poisoning with the caustic alkalies, as it is always at hand. It is also valuable, in weak dilution, to assist in removing particles of lime from the eye. It forms a valuable adjuvant to cooling lotions. The dose internally is from 1 to 4 fluid drachms; as an injection, 1 or 2 fluid ounces, diluted with twice or thrice its bulk of water (see *Acetum Destillatum*).

Specific Indications and Uses.—The deep-red tongue, with dark or brown coating.

Vinegar Preparations.—Acetum destillatum, *Distilled vinegar, Acetum purum.*

Preparation and Description.—Take of vinegar 8 parts, place in a glass or silver retort, and distill over into a receiver of similar material 7 parts. Dilute the product, if necessary, with distilled water, till the specific gravity is 1.006.

Distilled vinegar is recommended to be prepared from wine vinegar, chiefly on account of its aroma; and it should be prepared in glass or silver vessels, as lead or copper ones are extremely dangerous from the poisonous salts liable to be formed, viz.: the acetate of lead or copper. It is a clear liquid, occasionally with a yellowish tint, and differs from dilute acetic acid in containing a small proportion of alcohol, acetic ether, and mucilage. Excess of alkali added to it, and the solution heated, gives a brown color to the liquor, with a dark precipitate, which is supposed to be the decomposed mucilage. When of good quality distilled vinegar is quite colorless, of a pure acetous odor, frequently somewhat ethereal, but entirely unmixed with empyreuma or other disagreeable taint, and is wholly evaporated by heat. It is rendered unfit for pharmaceutical purposes by the presence of metals or mineral acids.

Distilled vinegar is used for the same purposes as above, and is the solvent to be employed in making the various medicated vinegars of opium, squill, colchicum, etc. Care must be taken, when using vinegar medicinally, not to obtain the spurious and adulterated articles, containing sulphuric acid, hydrochloric acid, nitric acid, copper, lead, etc. One part of acetic acid to 5 of distilled water forms a very good vinegar for culinary and medicinal purposes.

Acetum aromaticum, *Aromatic vinegar.*—Several aromatic vinegars have appeared in various pharmacopœias, some directing the use of oils to give the aromatic qualities, as in the formula of the *German Pharmacopœia*, and others directing the tinctures of the aromatic herbs, as in the *French Codex*. The following formula corresponds to that of the *German Pharmacopœia:* Take 1 part each of the essential oils of cinnamon (Cassia), juniper, rosemary, peppermint, and lavender; 2 parts each of oils of cloves and lemon; 450 parts of alcohol; 650 parts of acetic acid, and 1900 parts of water. An alcoholic solution of the oils is first prepared, the acid, and afterward the water, added, and the whole allowed to stand (with frequent shaking) 8 days, after which it is filtered. This gives a colorless, clear preparation, which will mix, without turbidity, with any amount of water. It has an acetous, aromatic odor. The *National Formulary* gives the following:

Acetum aromaticum (N. F.), *Aromatic vinegar.—Formulary number*, 1: "Oil of lavender, ½ cubic centimeter (0.5 Cc.) [8 ♏]; oil of rosemary, ½ cubic centimeter (0.5 Cc.) [8 ♏]; oil of juniper, ½ cubic centimeter (0.5 Cc.) [8 ♏]; oil of peppermint, ½ cubic centimeter (0.5 Cc.) [8 ♏]; oil of cinnamon (Cassia), ½ cubic centimeter (0.5 Cc.) [8 ♏]; oil of lemon, 1 cubic centimeter (1 Cc.) [16 ♏]; oil of cloves, 1 cubic centimeter (1 Cc.) [16 ♏]; alcohol, 175 cubic centimeters (175 Cc.) [5 fl℥, 440 ♏]; acetic acid (*U. S. P.*), 175 cubic centimeters (175 Cc.) [5 fl℥, 440 ♏]; water, a sufficient quantity to make 1000 cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏].

Dissolve the oils in the alcohol, add the acetic acid, and lastly, enough water to make one thousand (1000) cubic centimeters [33 fl℥, 391 ♏]. Warm the turbid mixture, during several hours, at a temperature not exceeding 70° C. (158° F.), taking care that it shall not suffer loss by evaporation. Then set it aside for a few days, occasionally agitating, and filter"—(*Nat. Form.*).

Acetum antisepticum, *Antiseptic vinegar.*—The *French Codex* directs an antiseptic vinegar prepared as follows: Take 15 parts each of Roman wormwood, rosemary, peppermint, sage, rue, lavender, and absinth; 2 parts each of nutmeg, cloves, cinnamon, garlic, and calamus; 1000 parts of vinegar. Macerate the whole 10 days, and after expressing, add 4 parts of camphor dissolved in 15 parts of glacial acetic acid. Filter.

ACETUM CANTHARIDIS.—VINEGAR OF CANTHARIDES.

Preparation.—Take bruised cantharides, 2 ounces; glacial acetic acid, 2 fluid ounces, and a sufficient quantity of acetic acid to make 20 fluid ounces. Mix with the glacial acetic acid 13 fluid ounces of acetic acid; add the cantharides and digest for a couple of hours at a temperature of 93.3° C. (200° F.). After the mixture has cooled, transfer it to a percolator, and when the fluid has ceased to pass add to the residue 5 fluid ounces of acetic acid. After completion of the percolation, press the residue, filter the fluid so obtained, and mix it with the percolate. Finally, by the addition of acetic acid bring the product to measure 1 pint (Imp.). This agrees with the *British Pharmacopœia.*

Action and Medical Uses.—This preparation is a speedy blistering agent. Applied to the skin lightly it acts as a rubefacient. But if applied in successive layers with a soft brush, vesication results in from one to three hours. It is convenient to apply to uneven surfaces where vesicating plasters are less likely to remain in contact. After application the blister should be dressed with simple ointment applied on cotton-wool, or soft linen. It is a painful application, and has been recommended for vesicating small areas in *superficial neuralgias* and *rheumatic parts.*

ACETUM IPECACUANHÆ.—VINEGAR OF IPECACUANHA.

Preparation.—Ipecacuanha (No. 20 powder), 1 ounce (av.); diluted acetic acid, q.s. for 20 fluid ounces (Imp.). After moistening the drug with a sufficient amount of the acid, macerate 24 hours, then pack the moistened powder in a percolator, and gradually add the diluted acid until 20 fluid ounces (Imp.) are obtained.

Description, Uses, and Dosage.—The foregoing process is in accordance with that of the *British Pharmacopœia*, and yields a yellow-brown preparation retaining permanently the emetic constituents in solution. A feeble, cutaneous irritant and expectorant. The uses are those of *Ipecacuanha*, which see. The dose ranges from 5 to 40 minims.

ACETUM LOBELIÆ.—VINEGAR OF LOBELIA.

Preparation.—Take of lobelia seed, in powder, 4 ounces; diluted acetic acid, 2 pints. Macerate the lobelia seed with the diluted acetic acid, in a close glass vessel, for 7 days; then express the liquor, filter, and add to the filtered product, alcohol (or concentrated acetic acid), 1 fluid ounce. The whole amount of fluid thus procured should measure 2 pints. This medicated vinegar may also be prepared by percolation.

History.—In this old eclectic preparation the alcohol is added to impede the decomposition, and as its quantity is very small, no objection can reasonably be made to its presence. We have known this preparation to retain its activity for two years, when kept well corked and not exposed to the action of light. We use lobelia seed instead of the herb, as employed in the *National Formulary* (see *Related Preparation*).

Action, Medical Uses, and Dosage.—Vinegar of lobelia is an emetic, nauseant, and expectorant, and is a valuable relaxant, in *spasmodic affections*, especially in *spasmodic* and *congestive disorders* of the *respiratory tract.* It may be given to fulfil all the indications for which lobelia is administered. Externally, it forms an excellent application in several *cutaneous diseases*, as *salt-rheum*, *erysipelas*, *poisoning by rhus*, etc. Dose, as an emetic, from 1 to 4 fluid drachms, repeated every 15 minutes; as an expectorant, from 5 to 30 drops or more, every half-hour, in elm or flax-seed infusion. One part of vinegar of lobelia added to 1 part, by measure, of syrup, forms a very pleasant preparation for children.

Related Preparation.—ACETUM LOBELIÆ (N. F.). (*U. S. P.*, 1880). *Vinegar of lobelia. Formulary number*, 2: "Lobelia, in No. 30 powder, 100 grammes (100 Gm.) [3 oz. av. 231 grs.]; diluted acetic acid (*U. S. P.*), a sufficient quantity to make 1000 cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with fifty (50) cubic centimeters [1 fl℥, 331.5 ♏] of diluted acetic acid, pack it firmly in a conical glass percolator, and gradually pour diluted acetic acid upon it until one thousand (1000) cubic centimeters [33 fl℥, 391 ♏] of percolate are obtained"—(*Nat. Form.*).

ACETUM OPII (U. S. P.)—VINEGAR OF OPIUM.

SYNONYM: *Black drop.*

Preparation.—"Powdered opium, 100 grammes (100 Gm.) [3 oz. av., 231 grs.]; nutmeg, in No. 30 powder, 30 grammes (30 Gm.) [1 oz. av., 25.5 grs.]; sugar, 200 grammes (200 Gm.) [7 ozs. av., 24 grs.]; diluted acetic acid, a sufficient quantity to make 1000 cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Macerate the opium and nutmeg in five hundred (500) cubic centimeters [16 fl℥, 435 ♏] of diluted acetic acid during 7 days, frequently stirring; then strain through muslin of close texture, and express the liquid. Mix the residue with two hundred (200) cubic centimeters [6 fl℥, 366 ♏] of diluted acetic acid to a uniform magma, and strain and express again. Mix and filter the strained liquids, dissolve the sugar in the filtrate, and pass enough diluted acetic acid through the filter to make the product measure one thousand (1000) cubic centimeters [33 fl℥, 391 ♏]"—(*U. S. P.*).

Assay.—"To assay this preparation, transfer 100 Cc. of it to a small capsule, add 4 Gm. of precipitated calcium carbonate, or such a quantity as will be sufficient to neutralize the free acid, and then proceed further as directed under *Tinctura Opii.* It should yield from 1.3 to 1.5 Gm. of crystallized morphine"—(*U. S. P.*).

Description and Dosage.—This preparation, unfortunately known as *black drop*, now contains 10 per cent of opium, the latter containing from 13 to 15 per cent of crystallizable morphine. It is a dark-brown-red liquid, almost free from the disagreeable taste and odor of tincture of opium and less liable to nauseate the patient. The name *black drop* should be discarded on account of its liability to confusion with *black draught.* The dose is from 5 to 10 drops.

ACETUM SANGUINARIÆ.—VINEGAR OF BLOODROOT.

Preparation.—Take of bloodroot, in powder, 4 ounces; diluted acetic acid, 2 pints. Macerate the bloodroot with the diluted acetic acid in a close glass vessel for 7 days; then express the liquor, filter, and add to the filtered product, alcohol (or concentrated acetic acid), 1 fluid ounce. The whole amount of fluid thus procured should measure 2 pints. This medicated vinegar may also be prepared by percolation.

History.—In this preparation diluted acetic acid is used instead of distilled vinegar. When kept well corked and in the dark, it may be preserved for a long time, though it loses its dark-red color. It is an old eclectic remedy, but a formula is now to be found in the *National Formulary* (see *Related Preparation*).

Action, Medical Uses, and Dosage.—Vinegar of bloodroot is seldom used as an emetic, except in combination with other agents of this class. Its chief employment internally is as an expectorant, hepatic, and alterative. As an external application it is useful in many *cutaneous affections.* Dose, from 10 to 30 drops, in some mucilage or syrup, and repeated 3 or 4 times a day.

Related Preparation.—ACETUM SANGUINARIÆ (N. F.). (*U. S. P.*, 1880). *Vinegar of sanguinaria. Formulary number*, 3: "Sanguinaria, in No. 30 powder, 100 grammes (100 Gm.) [3 ozs. av., 231 grs.]; diluted acetic acid (*U. S. P.*), a sufficient quantity to make 1000 cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏). Moisten the powder with fifty (50) cubic centimeters [1 fl℥, 332 ♏] of diluted acetic acid, pack it firmly in a conical glass percolator, and gradually pour diluted acetic acid upon it until one thousand (1000) cubic centimeters [33 fl℥, 391 ♏] of percolate are obtained"—(*Nat. Form.*).

ACETUM SCILLÆ (U. S. P.)—VINEGAR OF SQUILL.

Preparation.—"Squill, in No. 30 powder, 100 grammes (100 Gm.) [3 oz. av., 231 grs.]; diluted acetic acid, a sufficient quantity to make 1000 cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Macerate the squill with nine hundred (900) cubic centimeters [30 fl℥, 208 ♏] of diluted acetic acid during 7 days, frequently stirring; then strain through muslin, and wash the mass on the strainer with enough diluted acetic acid, until the strained liquid measures one thousand (1000) cubic centimeters [33 fl℥, 391 ♏]. Finally filter"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Vinegar of squill contains all the medicinal virtues of the squill. It is a clear, yellowish fluid, of a bitter acid taste, and possessing an acetous smell. It is sometimes employed as an expectorant in affections of the air vessels, and as a diuretic in *dropsies* caused by cardiac disease; but, on account of its tendency to decomposition, its principal use is in the preparation of syrup of squill. This preparation represents 10 per cent of squill. Its dose is from 15 to 60 minims, in some aromatic water.

ACHILLEA.—YARROW.

The whole plant, *Achillea Millefolium*, Linné.

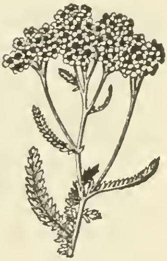
Nat. Ord.—Compositæ.

Common Names.—*Yarrow, Milfoil, Thousand leaf.*

Illustration: Bentley and Trimen., *Med. Plants*, 153; Woodville, *Med. Bot.*, 15.

Botanical Source and Description.—Yarrow is a common perennial plant from 1 to 3 feet in height, bearing dark-green, crowded, alternate, bi-pinnatifid leaves. The flowers, which are grayish-white (occasionally rose-colored), are arranged in a flat-top, corymbose head. The odor is peculiar, being pleasantly and highly aromatic, somewhat resembling chamomile. The taste is sharp, bitterish, astringent, and slightly saline.

Fig. 1.



Achillea.

History.—Yarrow is a common wayside herb, and is also found growing wild in fields, pastures, and waste places throughout the central portions of North America and Europe. It flowers from May to October, during which time it should be gathered (preferably during July), and after rejecting the coarser stems, should be carefully dried. The weight, after drying, is but 15 per cent of the amount collected. The leaves are more astringent than the flowers, the latter being more aromatic than the former. The American plant is said to be more valuable than the European species. Achillea was known to the ancients. Pliny states that the generic term, Achillea, was named from Achilles, a physician, who was one of the first to use a species of this plant as a vulnerary. Yarrow is sold by the native herbalists of India, like rosemary, where it is used as a bitter and in medicated vapor baths for fevers (Dymock). The Italians employed it in intermittent fevers, and in the Scottish highlands it is made into ointment for wounds. According to Linnæus the Dalecarlians used it as a substitute for hops in the making of ale, believing it to impart to it intoxicating qualities. Both Stahl and Haller used this plant extensively.

Chemical Composition.—Yarrow contains a reddish-brown, active, bitter principle called *achillein* ($C_{20}H_{38}N_2O_{15}$), discovered by Zanon, in 1846 (Liebig's *Annalen*), and shown by Von Planta (1870) to be alkaloidal and identical with the *achilleïne* of *Achillea moschata*. Zanon also found an acid which he named *achilleic acid*, and which was subsequently (1857) shown by Hlasiwetz to be *aconitic acid*. A small portion of a volatile oil, dark-green in color, may be obtained from yarrow by distillation with water. Milfoil also contains potassium and calcium salts, resin, gum, and tannin.

Action, Medical Uses, and Dosage.—Yarrow possesses slightly astringent properties, and is tonic, alterative and diuretic, in infusion. Its use in *chronic diseases of the urinary apparatus*, is especially recommended by Prof. J. M. Scudder. It exerts a tonic influence upon the venous system, as well as upon mucous membranes. It has been efficacious in *sore throat*, *hemoptysis*, *hematuria* and other forms of *hemorrhage* where the bleeding is small in amount, *incontinence of urine*, *diabetes*, *hemorrhoids* with bloody or mucoid discharges, and *dysentery;* also in *amenorrhœa*, *flatulency* and *spasmodic diseases*, and in the form of injection in *leucorrhœa* with relaxed vaginal walls. Prof. T. V. Morrow made much use of an infusion of this herb in *dysentery*. Given in half-drachm doses of the saturated tincture, or 20-drop doses of specific achillea, it will be found one of our best agents for the relief of *menorrhagia*.

The active principle, *Achillein*, has been employed in France and other portions of Southern Europe, as a substitute for quinine in the treatment of *intermittent fevers*. It has also been employed by French physicians to restore *arrested lochial discharges*.

Of infusion (℥i to Aqua Oj), 1 to 2 fluid ounces; specific achillea, 5 to 30 drops; volatile oil, 5 to 20 drops. All preparations of achillea are rendered more pleasant to the taste by the addition of a few drops of oil of anise.

Specific Indications and Uses.—To relieve urinary irritation, strangury, urinary suppression; relieves irritation in incipient Bright's disease, capillary relaxation, leucorrhœa with relaxed and irritated vaginal walls, hematuria, gastric and intestinal atony, atonic amenorrhœa, menorrhagia.

Related Species.—*Achillea Ptarmica*, Linné. *Sneezewort.* Naturalized in the Eastern States, growing in hedges, thickets, and moist places. The leaves are remarkably distinct from those of yarrow, being lance-linear, sessile, acuminate and serrate. The flowers are white and arranged in a diffuse corymb. Sialagogue and sternutatory.

Achillea moschata, Linné. *Iva*, *Musk milfoil.* An Alpine plant having the odor of musk, largely used by the Swiss as a sudorific and for its healing qualities. It contains *iraol* ($C_{12}H_{20}O$), a bluish-green or azure, bitterish, mintlike, volatile oil (called *Esprit d' Iva*, at Engadine, where it is extracted); *moschatine* ($C_{21}H_{27}NO_7$), a nitrogenous body; an alkaloidal principle, *achilleïne* ($C_{20}H_{38}N_2O_{15}$); and *ivain* ($C_{24}H_{42}O_3$) a yellow, soft bitter, soluble in alcohol. Upon boiling with dilute acids, achilleïne yields, besides sugar, ammonia, and an odoriferous principle, *achilletine* ($C_{11}H_{17}NO_4$), a non-bitter, insoluble, deep-brown body.

Achillea ageratum, Linné. Europe. This species has tufted, clammy leaves and a disagreeable odor and bitter taste. Used occasionally as a medicine.

Achillea nobilis, Linné. Europe. This pubescent species has a stronger taste and odor than common milfoil, and is sometimes used for similar purposes. The *Achillea nana*, Linné, and *Achillea atrata*, Linné, both natives of Europe, are likewise employed medicinally, the latter especially for its stimulating effects in the early stages of *fevers*.

ACIDUM ACETICUM (U. S. P.)—ACETIC ACID.

FORMULA: $HC_2H_3O_2=C_2H_3O.OH=CH_3.CO_2H$. MOLECULAR WEIGHT: 59.86.

"A liquid composed of 36 per cent, by weight, of absolute acetic acid [$HC_2H_3O_2=59.86$] and 64 per cent of water"—(*U. S. P.*).

SYNONYMS: *Acetyl hydrate*, *Hydrogen acetate*.

Source.—Acetic acid is the most extensively used organic acid, and is obtained either by the oxidation of alcohol and aldehyde, or by the destructive distillation of wood and carbohydrates in general. This yields an impure pyroligneous vinegar, which is subsequently purified. The greater portion of the acetic acid of commerce is now derived from this wood vinegar. As early as 1648 Glauber was familiar with the fact that vinegar could be obtained by the destructive distillation of vegetable tissues, but did not know that the substance so obtained was identical with the vinegar derived from alcoholic products. This identity was subsequently established (1800) by Vauquelin and Fourcroy. In 1802 Thénard proved its existence in products of dry distillation of animal tissues. Stahl proposed in 1700 a method to obtain acetic acid from vinegar by exposing the latter substance to a freezing temperature, separating the ice from the stronger acid; another method he suggested was to neutralize with an alkali and to evaporate, then distilling with an equal amount of sulphuric acid. In 1759 Count de Lauraguais obtained a crystallized acetic acid in a distillate of cuprum acetate, then known as "*copper spirit*." The name *glacial acetic acid* was affixed to this substance by Löwitz (1793), who repeatedly distilled diluted acetic acid with powdered charcoal, and obtained thereby a crystalline acid by subjecting the product to a low temperature.

Preparation and Description.—In order to bring before the reader the processes of the production of acetic acid it will be necessary to allude to the production of crude pyroligneous acid by the destructive distillation of woody substances. We shall then present the three commercial forms of acetic acid now in common use, viz.: acetic acid, glacial acetic acid, and diluted acetic acid.

I. ACIDUM ACETICUM PYROLIGNOSUM. *Acidum pyrolignosum. Pyroligneous acid, Pyroligneous vinegar.*

Preparation.—Crude pyroligneous acid is one of the principal products formed in the destructive or dry distillation of wood; *i. e.*, in the process of subjecting the wood to a red heat in a closed vessel, so that the air has no access. This is done at present in closed iron retorts, much on the same plan as the destructive distillation of coal is carried on in the manufacture of illuminating gas. The vapors are condensed in suitable vessels, and the incondensible, gaseous products frequently conducted back into the furnace. The liquid obtained separates upon standing into two layers—an upper, aqueous, and a lower, tarry layer, the latter furnishing the material from which creosote is obtained by rectification. It contains benzene and its homologues, naphthalene, retene, phenol, cresol, phlorol, pyrocatechol, guaiacol and homologues, and empyreumatic substances. The *upper stratum* is the crude pyroligneous acid of commerce, and is separated by mechanical processes. It contains in aqueous solution formic and acetic acids and their homologues, including capronic acid, methyl alcohol, acetone, acetates of methylamine, phenol, guaiacol, furfurol, and empyreumatic substances. From this liquid are obtained commercially: Acetic acid, acetone, and methyl alcohol. The first step of separation is that of fractional distillation of the crude pyroligneous acid. The first part coming over (10 per cent) is the alcoholic part, called *wood naphtha*, and consists of methyl alcohol, acetone, and methyl acetate, also containing allylic and other alcohols; then distills the acid part, called *purified pyroligneous acid* or *rectified wood vinegar*, amounting to 75 to 80 per cent. It is a yellowish or colorless acid fluid, possessing a smoky odor, which may be removed by agitating it with 2 or 3 per cent of benzin, and removing the latter by separation and distillation; then the aqueous residue will furnish an inferior table vinegar. The preparation of pure acetic acid from rectified wood vinegar will be described under "Acetic Acid." As to the quantities obtainable, 100 parts of wood yield from 20 to 35 per cent of gas, 3 to 9 per cent of tar, 35 to 45 per cent of crude pyroligneous acid, of which 3 to 9 per cent are acetic acid, and 20 to 30 per cent of charcoal. It has been found that the percentage of real acetic acid obtainable from diverse woods varies considerably; the bark yielding less than the wood, sound wood more than decayed wood, and stem woods yielding the greatest quantity, even more than the branch woods; foliage trees produce a greater yield of pure acid than needle-leaved species. Slow combustion is also conducive to a better yield. The average yield of acid liquor from 800 pounds of wood is about 300 pounds, or 35 gallons.

Description.—Crude pyroligneous acid is a dark-brown, sour liquid, of a smoky odor (due to furfurol [$C_5H_4O_2$], Meyer), holding in aqueous solution 4 to 7 per cent of acetic acid, empyreumatic oil, creosote, and pyroxylic spirit.

II. ACIDUM ACETICUM GLACIALE (*U. S. P.*). *Glacial acetic acid; Radical vinegar.*

Preparation.—Pure sodium acetate (13½ parts), in crystals, is carefully heated until the water of crystallization is completely driven off and the salt fused. The residue (nearly 8¼ parts by weight) is then reduced to a coarse powder and transferred to a retort. The retort is then carefully warmed in a sand-bath; and to the contained salt is added from 9½ to 10 parts by weight of strong sulphuric acid and intimately mixed. It is then distilled. The product, though containing some water, is glacial acetic acid. It may be obtained nearly free from water by distilling a portion and then pouring off the liquid, and finishing the distillation by repeating the operation.

Description.—Glacial acetic acid is the strongest preparation of acetic acid, and is so named on account of its ice-like appearance when crystallized. According to both the British and United States Pharmacopœias, it should contain at least 99 per cent of absolute acid. Below 15.5° C. (60° F.) it forms flat, colorless, ice-like, rhombic crystals. If heated above this point it changes to a syrupy, colorless liquid, which may again be cooled to 10° C. (50° F.), and remains fluid unless a crystal be dropped into it, when it again solidifies. Acetic acid of any form should not be kept in bottles stopped with rubber, as it is liable to be contaminated by substances used in the vulcanizing of the rubber. Glacial acetic acid dissolves camphor, oils, both volatile and fixed, gum-resins, resins, albumen, and fibrin. In contact with the skin it destroys the epidermal tissues and even produces vesication. It is thus described by the *U. S. P.:* "Nearly or quite absolute acetic acid. A clear, colorless liquid, of a strong, vinegar-like odor, and a very pungent, purely acid taste. When the acid is cooled to a temperature as near as possible to 15° C. (59° F.), but yet in a liquid form, its specific gravity should not be higher than 1.058, corresponding to at least 99 per cent of absolute acid. At a temperature somewhat below 15° C. (59° F.), the acid becomes a crystalline solid. When crystallized by cold it becomes liquid again at about 15° C. (59° F.). At 117° to 118° C. (242.6° to 244.4° F.) it boils, evolving inflammable vapors. Glacial acetic acid corresponds in properties to acetic acid (see *Acidum Aceticum*), and should respond to the same tests of purity; but the tint produced by the addition of 2 drops of decinormal potassium permanganate V.S. to 2 Cc. of the acid diluted with 10 Cc. of water, contained in a clean, glass-stoppered vial, should not be changed to brown within two hours. To neutralize 3 Gm. of glacial acetic acid should require not less than 49.5 Cc. of potassium hydrate V.S. (each cubic centimeter corresponding to 2 per cent of the absolute acid), phenolphtalein being used as indicator"—(*U. S. P.*).

III. Acidum Aceticum (*U. S. P.*). *Acetic acid.*

Preparation.—The acetic acid of commerce is derived from the action of sulphuric acid on pure sodium acetate, and indirectly from pyroligneous acid. Even fractional distillations of the latter acid, as pursued in obtaining rectified wood vinegar, will not completely purify it and chemical means must be resorted to in order to obtain pure acetic acid. Several methods are in vogue for this purpose. By the older method the crude pyroligneous acid was neutralized with milk of lime and the wood naphtha then distilled off; the remaining solution yielded upon evaporation to dryness a tarry residue of *brown acetate of lime*, containing only 68 to 69 per cent of pure acetate. By a later method, it is preferred to add milk of lime to the rectified wood vinegar (purified pyroligneous acid) and thus obtain by evaporation to dryness, a *gray acetate of lime* of much greater purity, containing 85 to 86 per cent of pure acetate.

Free acetic acid is then liberated from the acetates by distilling them with sulphuric acid, or preferably with hydrochloric acid which is added in a quantity just sufficient to convert the calcium into $CaCl_2$. It is also preferred to convert the calcium acetate into sodium acetate before distilling with acid, by the double decomposition of calcium acetate and sodium sulphate. The sodium acetate is then carefully purified by evaporation and repeated recrystallization, finally being fused in an iron vessel, stirred until dry, and gently heated to incipient carbonization, thus ridding it of remaining empyreumatic impurities, and pure sodium acetate results. By distilling this salt with about 35 per cent of its weight of sulphuric acid the acetic acid of commerce is obtained. The remaining smoky flavor and odor may be removed by passing it through animal charcoal, or distilling it with bichromate of potassium.

Description.—Acetic acid of commerce is a solution of pure acetic acid in water, and according to the *United States Pharmacopœia* should contain 36 per cent of the stronger acid. It should be clear, colorless, free from empyreuma, of a pure, intense sour taste, and of an acetous odor. Its specific gravity is about 1.048 at 15° C. (59° F.) (*U. S. P.*). It mixes freely with water and alcohol in all proportions, and should volatilize completely without residue (*U. S. P.*). Acetic acid gives rise to a line of salts known as the acetates. The salts (most of them are soluble) in solution, upon the addition of a solution of ferric salts, acquire a dark brown-red color, which vanishes when hydrochloric acid is added. If acetic acid be neutralized (or even left slightly acid) with solution of ammonium hydroxide and treated with the pharmacopœial test solution of ferric chloride, a blood-red color results which may be discharged by adding to it an excess of sulphuric acid. The quality and odor of acetic acid are developed with age. According to Dr. E. R. Squibb, a sample of the freshly distilled acetic acid tested by the odor would not be recognized as the same substance a few months later.

Many methods have been given for determining the amount of absolute acid in a given sample of the official preparation. The following test is accurate and will answer all practical purposes. Treat 200 grains of the acetic acid with a weighed excess of dry, pure calcium carbonate. Wash from it the calcium acetate thus formed, dry the residue, and weigh the insoluble carbonate. Multiply the loss in grains by three-fifths which will give the percentage strength of absolute acid.

Tests.—"When the acid is slightly supersaturated with ammonia, tne liquid should not have a bluish tint (absence of copper), nor should any residue be left after evaporating the alkaline liquid on the water-bath (absence of other fixed impurities). Acetic acid diluted with 20 volumes of water should neither become colored nor yield a precipitate with hydrogen sulphide T.S. (absence of lead, copper, etc.). Acetic acid diluted with 10 volumes of water should not yield a precipitate or turbidity with barium chloride T.S. (absence of sulphuric acid), or with silver nitrate T.S. (absence of hydrochloric acid). If a portion of the acid be just neutralized by ammonia, then mixed with some silver nitrate T.S., and warmed, the liquid should not turn dark-colored or deposit a dark-colored precipitate (absence of formic or sulphurous acid). When the acid is slightly supersaturated by sodium or potassium hydrate T.S., the liquid should not have a smoky odor or taste. And if 5 drops of decinormal potassium permanganate V.S. be mixed with 2 Cc. of the acid previously diluted with 10 Cc. of water, and contained in a clean, glass-stoppered vial, the pink tint should not change at once to brown, but should change only gradually, and not become entirely brown, or free from pinkish-brown, in less than half a minute (limit of empyreumatic substances). To neutralize 6 Gm. of acetic acid should require 36 Cc. of normal potassium hydrate V.S. (each Cc. corresponding to 1 per cent of the absolute acid), phenolphtalein being used as indicator" (*U. S. P.*). (See also *Acetum Destillatum*).

IV. ACIDUM ACETICUM DILUTUM (*U. S. P.*).—*Diluted acetic acid.*

Preparation: According to the *British Pharmacopœia*, this form contains acetic acid 1 part, distilled water 7 parts, by measure. These proportions are to be preferred to those of the *U. S. P.*, which directs a mixture of 100 parts of acetic acid to 500 parts of distilled water. The former preparation is about the strength of ordinary vinegar, and is to be preferred on that account inasmuch as it can be conveniently used in preparations where vinegar is directed, making a much finer preparation.

Description: According to the *United States Pharmacopœia*, "Diluted acetic acid contains 6 per cent, by weight, of absolute acetic acid. Specific gravity, about 1.008 at 15° C. (59° F.). It corresponds, in properties to acetic acid (see *Acidum Aceticum*), and should respond to the same tests of purity. To neutralize 24 Gm. of diluted acetic acid should require 24 Cc. of potassium hydrate V.S. (each Cc. corresponding to 0.25 per cent of the absolute acid), phenolphtalein being used as indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Applied to the skin glacial acetic acid will cause vesication followed by a painful sore. Acetic acid acts upon the integument as a mild irritant unless its contact be prolonged, when it blisters and finally destroys the epidermis. Mucous tissues are turned first white and then brown by it. If a large dose be swallowed violent, burning, gastric pain with vomiting and diarrhœa results. Cases of fatal perforation have occurred from accidental swallowing of this acid. It reduces temperature and slows the pulse when taken in diluted form. Its continued use produces changes in the blood corpuscles, by its action on the alkalinity of the blood. When it kills it does so by arresting the heart's action. Convulsions and coma have preceded death when glacial acetic acid has been swallowed, and when not fatal it has produced gastro-enteritis. In cases of poisoning by this acid weak alkaline solutions should be immediately administered, followed by the use of milk and mucilaginous drinks. The stomach-pump should be employed to evacuate the stomach.

I. PYROLIGNEOUS ACID. Fish and meats, fresh or salted, immersed for a few seconds in crude pyroligneous acid, acquire a smoky taste, and are as well cured as by the usual method of smoking, besides being preserved from "skippers." Silliman found that if a quart of this acid be added to the pickling liquid when hams are packed in it, they would have as perfect a smoky flavor as if they had gone through the usual process of preparation by smoking. This acid is stimulant and antiseptic. The diluted acid may be used as a local application for arresting or preventing *sloughing*, for cleansing *old or gangrenous sores, abscesses*, and *burns, scalds, ringworms, tinea capitis, excoriated nipples*, etc., and as a gargle in *inflamed* and *ulcerated throat*, and *scarlatina maligna*. Internally, in doses of from 10 to 30 drops, it is useful in all cases where an antiseptic is indicated. The pyroligneous tar forms a valuable irritating plaster.

II. Glacial Acetic Acid. This acid attacks flesh and is too concentrated for internal use. It destroys the epidermis and may produce a painful sore. It may be used to destroy growths, such as *warty excrescences, corns*, and occasionally as a vesicant. This form of acid is one of our best agents for the cure of *ringworm*. The parts should be touched with a hair pencil dipped in the acid. *Ulcers, papillomata, lupus, epithelioma*, and *nasal polypi* have been successfully treated with it. It is an excellent application in *scald head*, though care should be exercised in its use not to produce an ulcerated condition of the scalp. M. Ricord speaks highly of this acid as a local application to *venereal ulcers* in the primary stage, to be applied as freely as any other caustic, and repeated as often as the condition of the *chancres* may require. Under its influence the ulcer speedily assumes a healthy aspect and promptly heals. He believes that it neutralizes the venereal poison, and thus obviates all danger of constitutional symptoms.

III. Acetic Acid. Acetic acid is well known for its property of preserving vegetable substances, such as pickles, etc. It is antiseptic, refrigerant, astringent, and excitant. Its volatility renders it efficient for inhalation in cases of *fainting, suffocation, headache*, and *hoarseness*. A small quantity of acetic acid poured into the vessel containing the feces of *typhoid fever* patients, as well as those suffering from *tubercular consumption* and *tubercular diarrhœa*, will destroy the offensive odor arising therefrom. Acetic acid is claimed to be the only agent that will "liquefy and disorganize *cancer cells*." For this purpose a dilution of acetic acid has been applied to *epitheliomata* for the purpose of destroying the nature of the growths. This must be done, however, before the axillary or other glands have become involved. Fair success has attended this practice which is to be pursued only when the patient refuses to have the cancerous growth removed. Injected hypodermatically into *nasal polypi*, pure acetic acid has been found to quickly cause the tumors to shrivel and drop away. Should they suppurate and become offensive, deodorants, such as asepsin or borax, may follow its use to overcome the stench arising therefrom. Acetic acid 1 part, distilled water 2 parts, has been of service as an injection in *gonorrhœa*.

IV. Diluted Acetic Acid. Diluted acetic acid is always an efficient antidote for *poisoning* by the caustic alkalies. If this be not at hand diluted vinegar (which is an impure acetic acid) is always to be obtained and should be employed in such cases. This acid applied to an *urticarious eruption* will usually allay the disagreeable itching. It checks moderate *hemorrhages*, consequently it may be given in *hematemesis*, and applied to *superficial wounds* and in the nose for the relief of *epistaxis*. It may be applied to *ringworm* when it is not desirable to employ the stronger acid. Used as a lotion it will prevent the occurrence of *bed sores*, and added to the bath will frequently be beneficial in reducing temperature in *febrile conditions*. Vinegar may be employed for the same purposes. Diluted acetic acid has been given to check the *colliquative sweating* of phthisical patients. Acetic acid is not often used internally, but when so used this form is selected, and the indications below given are the guides to its use.

Specific Indications and Uses.—Deep redness of tongue and mucous surfaces.

Preparations.—Camphorated Acetic Acid. Half an ounce of camphor triturated with a little alcohol to reduce it to powder, and then dissolved in 6 fluid ounces of this acid, forms the Camphorated Acetic Acid of the *Dublin Pharmacopœia*, which is a pungent stimulant when snuffed up the nostrils; as it is extremely volatile, and corrodes nearly all common metals except gold, it should be kept in glass vials, with ground-glass stoppers. *Henry's aromatic vinegar* is merely an acetic solution of camphor, oil of cloves, lavender, and rosemary.

Related Acids.—Acidum Trichloraceticum, *Trichloracetic acid*, (CCl_3COOH). When chlorine acts upon acetic acid chloracetic acid in three modifications is formed accordingly as the hydrogen atoms are replaced with one, two, or three atoms of chlorine, resulting respectively in *mono-chloracetic, di-chloracetic*, and *tri-chloracetic acids*, the latter of which is used in medicine. It may also be prepared by acting upon anhydrous chloral with fuming nitric acid—a process of oxidation. It forms colorless, very hygroscopic, rhombic crystals, having a faintly pungent smell, and strongly reddening litmus. At 55° C. (131° F.) it fuses; at 195° C. (463° F.) it boils. Chloroform ($CHCl_3$) and carbon dioxide (CO_2) are formed when it is decomposed by boiling with an excess of sodium carbonate. It has been used from full strength to 50 per cent solutions as a cauterant, and is likewise used in urinary analysis as a test-reagent for albumen (Coblentz). As a cauterant it is said to cause less pain than the commonly employed caustics, and the pain (in mucous tissues) may be wholly obtunded by the previous application of cocaine. In its action it somewhat resembles nitric acid, penetrating deeply without much inflaming the surrounding tissues, and the small, dry, and smooth, white eschar soon falls off, exhibiting granulations, and the sore very quickly heals. Very little contraction takes place and the scar is inconsiderable. It has been employed for the removal of *papillomata, lupus, vascular nævi, warts, condylomata*, and various *neoplasms*. To a limited extent it has been used to cauterize the mucous surface after the removal of *exuberant growths of the middle ear* (Foltz). A 20 per cent solution has been affirmed (Lanz) to cure obstinate *gleet* by cauterization.

ACIDUM ARSENOSUM (U. S. P.)—ARSENOUS ACID.

FORMULA: As_2O_3 MOLECULAR WEIGHT: 197.68.

SYNONYMS: *Arsenic, Arsenicum album, White arsenic, Arsenious anhydrid, White oxide of arsenic, Arsenious oxide, Arsenious trioxide, Arsenic trioxide, Arsenious acid.*

History and Source.—Geber was the first to mention white arsenic, stating that he obtained it by roasting the sulphide of arsenic. Albertus Magnus was the first to state that a metal-like substance was contained in white arsenic. The element is found native in the Hartz Mountains and in Hungarian and Bohemian mines, but occurs more frequently in combination with sulphur as realgar and orpiment, or combined with sulphur and iron as arsenical pyrites or mispickel. This form of pyrites may be found in the New England States, particularly Connecticut and New Hampshire. It also occurs in combination with iron, cobalt, nickel, tin, and silver (as arsenides). It is present, to a slight extent, in some mineral springs and in the ashes of certain plants. It has been found, according to Orfila in the soil of cemeteries.

Preparation and Description.—Arsenous acid is obtained on a large scale in Saxony and Bohemia, mostly as a by-product, in the roasting of arsenical ores. The vapors of the trioxide formed are condensed in the form of crude flowers of arsenic, a white crystalline powder. In the Silesian works at Altenburg and Reichenstein it is obtained in large quantities from the smelting of arsenical iron pyrites. The crude product is purified by repeated sublimation.

The *U. S. P.* describes it as follows: "A heavy solid, occurring either as an opaque, white powder, or in irregular masses of two varieties—the one amorphous, transparent, and colorless, like glass; the other crystalline, opaque, or white, resembling porcelain. Frequently the same piece has an opaque, white, outer crust enclosing the glassy variety within. Contact with moist air gradually changes the glassy into the white, opaque variety. Both are odorless and tasteless. In cold water both varieties dissolve very slowly, the glassy variety requiring about 30, the porcelain-like about 80 parts of water at 15° C. (59° F.). Both are slowly but completely soluble in 15 parts of boiling water. In alcohol, arsenous acid is but sparingly soluble, but it is soluble in about 5 parts of glycerin. Oil of turpentine dissolves only the glassy variety. Both varieties are freely soluble in hydrochloric acid, and in solutions of alkali hydrates and carbonates"—(*U. S. P.*).

The specific gravity of the transparent variety is 3.73; of the opaque, 3.69. It is brittle, breaking with a shell-like fracture. Tartaric acid increases its solubility; it is insoluble in ether. It is incompatible with lime-water and decoction of barks generally.

Tests.—The Pharmacopœial tests are as follows: "When heated to 218° C. (424.4° F.), arsenous acid is completely volatilized without melting. When thrown on ignited charcoal, it emits an alliaceous odor. When its vapor is passed through red-hot charcoal, in an arsenic-tube, it is deoxidized, and metallic arsenic is deposited on the cooler portion of the tube as a mirror having a metallic luster. An aqueous solution of arsenous acid has a fainly acid reaction upon litmus paper. Silver ammonium nitrate T.S. produces in the solution a lemon-yellow precipitate, which dissolves on addition of ammonia water; when this solution is heated, metallic silver is deposited (distinction from arsenic acid). Copper ammonium sulphate T.S. produces a bright green precipitate, which dissolves in ammonia water with a deep blue color. Hydrogen sulphide T.S. colors the solution of arsenous acid yellow; if a few drops of hydrochloric acid are added, it precipitates lemon-yellow arsenic trisulphide, which should be completely soluble in ammonium carbonate T.S. (absence of antimony, tin, and cadmium). When arsenous acid is carefully heated in a dry test-tube of hard glass it should sublime without leaving a residue, and the sublimate should not at first show a yellow color (absence of non-volatile matter and of arsenic sulphide). If 1 part of arsenous acid be dissolved in 10 parts of ammonia water, with the aid of a gentle heat, the solution should neither leave an insoluble residue, nor show a yellow or other color; nor should the addition of a slight excess of hydrochloric acid produce a a precipitate (absence of metallic impurities, sulphides, etc.). If 0.1 Gm. of arsenous acid be dissolved, together with 1 Gm. of sodium bicarbonate, in 20 Cc. of water by the aid of a gentle heat, it should decolorize not less than 20 Cc. of decinormal iodine V.S. (corresponding to at least 98.8 per cent of arsenic trioxide)"—(*U. S. P.*).

In addition the following tests for arsenic and its oxides are of importance:

Marsh's Test: Take a Woulff bottle with double tubulature, provide each with a perforated cork; through one of these fit a funnel tube reaching to nearly the bottom of the bottle; connect the other tubulature by means of a bent glass tube with a horizontal wide tube containing a layer of pieces of caustic potash and one of calcium chloride, and by means of a tight-fitting cork add a narrower horizontal tube of hard glass, narrowed in one or two places and ending in a tapering jet bent upward. Place into the bottle some pure zinc, free from arsenic, and add through the funnel tube a mixture of 1 part of arsenic-free sulphuric acid and 5 parts of water. When all the air in the apparatus is displaced by the hydrogen gas (which is best ascertained by collecting the gas in a test-tube and igniting its contents in the flame of a spirit lamp) ignite the hydrogen issuing from the tapering end, and add through the funnel tube the liquid to be tested. If arsenous acid is present, AsH_3 will be formed (arseniuretted hydrogen, arsin), which turns the otherwise faintly blue hydrogen flame a luminous, bluish-white color, and in burning produces white fumes of arsenous oxide.

The following reactions will establish the identity of arsenic present:

1. Hold a cold plate of porcelain into the flame of AsH_3, taking the precaution to nearly touch the glass jet. AsH_3 is then decomposed, and a black spot of arsenic is deposited upon the plate, soluble in solution of sodium hypochlorite (difference from antimony). The arsenic spots are also soluble in warm nitric acid. If a drop of $AgNO_3$ be added, and a drop of aqua ammoniæ held over it, a yellow spot of silver arsenite or a red spot of silver arsenate is formed. Antimony under like conditions causes a *black* precipitation of silver and some antimony.

2. Heat the tube through which the AsH_3 passes by means of a spirit lamp; a mirror of metallic arsenic will be deposited in the colder parts of the tube. If afterward sulphide of hydrogen is passed over the metallic mirror, at the same time warming it, it is transformed into lemon-yellow, As_2S_3. (The corresponding antimony compound would be orange-red.)

Marsh's test is especially available for the detection of arsenic in cases of poisoning, for which purpose the suspected organic substances are previously treated, under certain precautions, with strong sulphuric acid, later with nitric acid (Danger and Flandin), or preferably with hydrochloric acid and potassium chlorate (Fresenius and Babo).

Reinsch's Test: If an aqueous solution of arsenous acid be boiled for 10 or 20 minutes with one-tenth to one-sixth its bulk of pure hydrochloric acid, and fine copper gauze, or thin copper wire, the latter acquires an iron-gray metallic coating of arsenic. If now the coated copper be washed, dried, cut into small pieces, and then heated in a glass tube or reduction tube by the flame of a spirit lamp, the metallic arsenic is volatilized, and sometimes yields a metallic ring; but in general it becomes oxidized, and yields a sublimate of minute octahedral crystals. The arsenous acid thus obtained in the tube should be dissolved in water and tested with hydrogen sulphide, ammonio-nitrate of silver, etc., or it may be tried by Marsh's process. In using Reinsch's test great care should be taken in ascertaining the purity of the copper, as arsenic is often present.

When the arsenous acid is contained in organic substances, as stomach, liver, etc., these must be cut into small pieces, and boiled in water acidulated with hydrochloric acid, until all the tissues are dissolved, or broken down into fine flakes or grains. Filter through calico, heat again to the boiling point, and proceed by Reinsch's process, as previously described.

Bettendorff's Test: To a small quantity of the liquid to be tested add pure concentrated hydrochloric acid and an equal volume of a saturated solution of freshly-prepared stannous chloride in pure hydrochloric acid. The presence of arsenic is revealed by the production of a brown color or brown precipitate, the appearance of which is hastened by a gentle heat.

Fleitmann's Test: See *Reagents and Test Solutions.*

Action and Toxicology.—Arsenic in very small doses accelerates the circulation, and has a tonic effect on the nervous system. It enables one to take active exercise with but little fatigue, and without materially interfering with respiratory action. Certain arsenic-eaters among the Styrians become habituated to its use, taking as much as 4 to 10 grains daily. They are careful, however, not to drink water for some time after taking it.

In large doses, arsenous acid is a most violent poison, producing in overdoses, nausea, vomiting, burning pain of the throat and stomach, soon extending over the whole of the abdomen. Although under certain circumstances, a large amount of arsenous acid has been swallowed without any serious effects, yet as a general rule, it is considered that death may be produced by 1 or 2 grains of it taken at a dose. A larger quantity may cause vomiting so quickly as to expel it from the stomach before its deleterious action fairly commences; and a distension of the stomach with food has prevented it from proving fatal. Yet there is much uncertainty in these matters, as experience has demonstrated. When emesis is caused by its poisonous action, the matters vomited may be bilious or tinged with blood, occasionally there will be no pain or vomiting. There is very apt to be a sense of heat, dryness, and constriction of the throat, with incessant thirst and great difficulty of swallowing. When the bowels are inflamed the abdomen is tense and hard, with loose, bloody stools, tenesmus, heat, and excoriation of the anus. The urine may be diminished or suppressed; pulse quick, small, feeble, and irregular; heart beating irregularly with palpitation; breathing laborious and often painful; tongue dry and furred; with frequently tremblings, cramps, and delirium previous to death; occasionally dark spots or an eruption on the surface will be present. The symptoms are by no means uniform, and will vary with different individuals; there may be faintness, or actual syncope, convulsions, paralysis, great prostration, coma, etc. In some cases death may ensue without any severe or well-marked symptoms. When arsenic is taken in small doses, continued for a long period, but acting as a slow poison, "there will be a gradual sinking of the powers of life, without any violent symptom; a nameless feeling of illness, failure of the strength, an aversion to food and drink, and all the other enjoyments of life." Among the many symptoms which have been observed in such cases, the following are the principal: flatulence, heat or pain in the stomach and bowels, loss of appetite, thirst, nausea, vomiting, purging, or a loose condition of the bowels, with griping; the tongue furred, mouth and throat dry and constricted, and sometimes salivation. The pulse will be quick, small, and often irregular; a dry cough, with oppressed respiration; wasting of the body; very irritable stomach, immediately rejecting anything thrown into it. Headache, giddiness, wakefulness; irritation of the conjunctiva, the patient frequently complaining of a feeling like a hair or cobweb in the eye, with redness, swelling or pricking of this organ; the limbs painful, feeble, trembling, subject to numb sensations, cramps, or convulsions. An eruption on the surface, falling off of the hair and nails; swelling of the face and feet, and gradual sinking of the patient, with consciousness perfect to the last, or perhaps coma, or delirium. Arsenic, whether taken internally or absorbed from its external application to a wound, almost always occasions gastritis or gastro-enteritis. Beside the stomach and bowels, it also appears to exert a specific influence over other parts of the system, as the heart, nerves, lungs, skin, etc., causing irritation, inflammation, and gangrene, as may be observed by an inspection of these organs after death. Applied to the skin, especially if the epidermis be removed, it acts as a powerful caustic.

In the treatment of cases of poisoning by arsenic, the first thing to be done is to remove as much of the poison from the stomach as possible, either by employing the stomach-pump, or producing vomiting by tickling the throat and fauces with a feather or the finger, and emetic doses of sulphate of zinc, or sulphate of copper. None of the nauseating emetics must be used, as lobelia, ipecacuanha, etc., as they do not act with sufficient promptness, and favor absorption of the poison by their prolonged nausea previous to vomiting. To sheathe the stomach, and at the same time diminish the solubility of the arsenous acid, demulcents (as milk, white of egg, mucilage, syrup, etc.), and lime-water may be used freely; these likewise promote vomiting. If it is supposed that any of the poison has entered the intestines, the best purgative for its expulsion is castor-oil.

Antidotes should be administered as soon as they can be had; several have been named, as charcoal, and light calcined magnesia, swallowed in large quantities. But the best antidote is, the recently made, pulpy, hydrated sesquioxide of iron (hydroxide of iron), prepared by precipitation with ammonia. It should be given to an adult in tablespoonful doses every three or four minutes, until the severe symptoms have ceased. Dr. Maclagan observes "that as far as chemical evidence goes, at least twelve parts of oxide, prepared by ammonia, and moist, are required for each part of arsenic." The hydroxide of iron may, however, be given in much larger amount, as it is completely free from any deleterious action; and the sooner it is given after the poison has been swallowed, the more prompt and certain will be its effects. It forms with the poison an innocuous salt, the ferrous arsenate.

Any inflammatory symptoms which may be present, excessive pain, or great prostration, must be treated on general principles; and great care should be observed during convalescence, which is apt to be very tedious, to keep the patient upon fluids only, of a nutritious character, permitting no solids, until all danger of gastro-enteritis has passed.

Action and Medical Uses.—Arsenic is a very positive medicinal agent when properly employed, and one capable of incalculable injury when injudiciously administered. As Prof. Scudder has very properly indicated, the dose should be very small, and the remedy should never be employed unless the indications for its use are clearly present. That much of the discredit that has fallen upon this agent is due to its indiscriminate use in inordinate doses, we are fully satisfied. That it is a blood-maker, improves nutrition, and is a powerful vital stimulant, is well established, and it is in this direction that it has been used by Eclectic practitioners. From a series of experiments in dosage, Profs. Howe and Locke came to the conclusion that the most favorable and proper medicinal dose of Fowler's solution, the most commonly employed preparation, should be one-half drop. The conditions calling for arsenical preparations are a low condition of the blood with a tendency to the deposition of cacoplastic material—imperfect albuminoids—caseous and yellow tubercular formations, tissue degeneration, and impaired nutrition. Irritability and erethism of the nerve centers, and particularly of the sympathetic system, always contraindicate its use.

Arsenic has long been a remedy for *malarial affections*. In properly selected cases its action is admirable. These cases are those exhibiting torpor of the sympathetic centers with a general lack of nervous excitation. The malarial cachexia is marked and the periodicity irregular. The pulse is weak and compressible, limbs cold, tongue pale and without expression, and the tissues flabby. Added to these, in these disorders as well as in all cases calling for arsenic, we observe a muddy or dirty hue of the skin, and when a fold of the latter is taken between the fingers it retains the pinched-up form, very slowly returning to its natural condition, thus lacking that elasticity possessed by the cutaneous tissues in health. Such conditions in *adynamic typhoid states* indicate arsenicum. In *atonic diarrhœa* with indigestion, in *cholera infantum* with marked enfeeblement, and frequent, thin, non-mucoid discharges, and in periods of great depression followed by hectic fever, arsenic exhibits its curative power, the indications above given being always present. Here it undoubtedly cures by its action as a nerve stimulant. ℞ Fowler's solution, gtt. x; aqua, fl℥iv. Mix. Sig. Dose, a teaspoonful every two or three hours.

Anemia has been very successfully treated with small doses of arsenicum. It is adapted where the constitutional debility is marked, and the nervous forces greatly depressed. Webster asserts it of most value in *chlorotic conditions* associated with *metrorrhagia* and *choreaic complications*; also in the *anemia of malarial cachexia*, though in the latter instance he prefers the arsenate of quinine to arsenic itself. Rare cases of *pernicious anemia* have been benefited by it. *Puerperal* and *dyspeptic anemia* sometimes yield to it.

Howe, Scudder and others have pointed out the value of arsenic in *tubercular disorders*. Prof. Howe used Fowler's solution and veratrum very extensively in *phthisis*. The arsenical preparation was usually prescribed as follows: ℞ Fowler's solution, fl℥ss; syr. lactophosphate of calcium, fl℥vj. Sig. Dose, a teaspoonful 3 times a day every other day. *Chorea* and *obstinate neuralgias* are favorably impressed by arsenic. The former is most amenable when associated with malarial cachexia, or with chlorotic anemia. Quite large doses are sometimes permissible in this condition, though as a rule, when indicated, the small doses succeed best. The neuralgias best met by it are those of a miasmatic type, especially when confined to the intercostal and fifth cranial nerves. In fact most neuralgias are more or less benefited by it, for the majority are due to general debility. In all these conditions where malaria forms a part of the trouble, the arsenate of quinine in 2x trituration acts nicely. Arsenic bromide seems to have some claim to efficiency in *epilepsy*, and has been recommended in *diabetes mellitus*.

Excellent results have been obtained from the use of arsenicals in *chronic gastritis* with burning sensations and where the trouble is due to cutaneous eruptive retrocessions; in *duodenitis*; and in *cholera infantum*, during the last stages, the arsenite of copper relieves the intestinal pains, checks the discharges, and exerts its tonic effect. *Semi-chronic dysentery* with impaired vitality of the mucous tissues is favorably impressed with arsenic. In all these conditions the minute dose is to be preferred.

It is in *skin affections*, however, that arsenic has had the widest application. Even when used indiscriminately its effects have largely been favorable, but brilliant results have attended it when specifically applied. Here the general indications above given apply, and the classes of disorders are those of a chronic nature of the squamous, vesicular, and tubercular types, and sometimes those of a pustular character. Long continued use of the small doses is necessary. The affections in which it has proved of value are *eczema*, *psoriasis*, *lupus*, *lepra*, *pityriasis*, *impetigo*, *ichthyosis*, *elephantiasis*, *pemphigus*, *warts*, *prurigo* and *lichen ruber*, etc. Syphilitic manifestations are not much benefited by arsenic alone, though *articular nodosities* of syphilitic origin are said to have been benefited by it. Donovan's solution, however, is of benefit in *secondary syphilis* with the tongue small and unduly red.

Applied externally, after removing the epidermis, arsenous acid is a powerful caustic, used in the treatment of *cancerous ulcers*, *lupus* or *noli me tangere*, *epithelial cancer*, *onychia maligna* and *chancres;* but its application requires the greatest caution, on account of fatal accidents which might occur from its absorption, as well as from the erysipelatous inflammation it is apt to occasion. It is seldom employed for this purpose by reputable physicians, though it forms a large element in the "cancer cures" of so-called "cancer specialists." It has been applied in various forms, thus: 1. Arsenous acid, sublimed sulphur, of each 1 drachm, spermaceti cerate 1 ounce; to be applied on lint, for 24 hours, and then to be removed—when the slough comes away, dress the ulcer with simple ointment. 2. Arsenous acid 2 grains, spermaceti ointment 1 ounce. 3. *Arsenical paste* (Rousselot's). Arsenous acid 1 part; red sulphide of mercury 16 parts; powdered dragon's blood 8 parts; applied over the ulcer. The *French Codex* prescribed 8 parts instead of one of arsenic. Various other forms, both for the internal and external use of arsenous acid, have been recommended by members of the profession.

Arsenic is largely used in *dental surgery* to insert into dental cavities for the purpose of destroying the nerve pulp. It is a very painful application, though it is generally combined with creosote, or carbolic acid and morphine, which somewhat obtund the pain. From $\frac{1}{60}$ to $\frac{1}{30}$ grain is inserted and covered in such a manner that it can not escape from the cavity.

The dose of arsenous trioxide is from $\frac{1}{100}$ to $\frac{1}{15}$ grain; in 2x or 3x trituration, 3 grains 3 or 4 times a day; Fowler's solution, fraction of a drop to 5 drops; liquor acidi arsenosi (1 per cent), 1 to 5 drops; liquor sodii arsenitis (*U. S. P.*), 1 to 5 drops; arsenic iodide, $\frac{1}{50}$ to $\frac{1}{15}$ grain; Donovan's solution, 1 to 5 drops; Clemens' solution (bromide of arsenic), 1 to 3 drops a day, well diluted, after meals; arsenate of quinine, 2x trit., 3 grains 3 or 4 times a day.

The administration of arsenicals must be at once stopped when they produce swelling of the face and eyelids, with irritation of the conjunctiva, and disorder of the digestive organs.

Specific Indications.—Skin muddy, dull, sallow or pallid, and inelastic; epidermis dry; irregular periodicity in malarial cachexia; squamous, vesicular, and tubercular skin affections; deposits of low albuminous matter, yellow tubercle and caseous formations; impaired sympathetic innervation and general lack of nerve force; pulse soft and easily compressed; extremities cold; secondary syphilis with tongue small and increased in redness (Donovan's solution only); pallid, œdematous skin; muscles flabby. Periodicity not cured by quinine; eyes dull; tendency to hemorrhage; tongue pale and expressionless.

Preparations.—Fowler's Solution. (*Liquor potassii arsenitis. Arsenical solution.*) Solution of arsenite of potassium, representing 1 per cent of arsenous acid.

Donovan's Solution. (*Liquor arseni et hydrargyri iodidi.*) Contains 1 per cent each of iodide of arsenic and red iodide of mercury.

Liquor Acidi Arsenosi. A 1 per cent solution of arsenous acid.

Pearson's Arsenical Solution. Solution of arsenate of sodium.

De Valangin's Solutio Solventis Mineralis. (*Liquor arsenici chloridi.*) A solution of chloride of arsenic.

Asiatic Pills. Contain arsenous acid $\frac{1}{16}$ gr., black pepper $\frac{1}{2}$ gr., mucilage of acacia q. s., to form a pill. (For preparation of above solutions, see Liquors.)

Related Compound.—Smalt. Azure. Smalts.—Cobaltic oxide (impure) prepared by roasting native cobaltic arsenide, and fusing the product with potassa and sand. The result is a handsome blue glass, which, when powdered, is given the above names. It is used for coloring glass, porcelain, etc., and in sign painting.

ACIDUM BENZOICUM (U. S. P.)—BENZOIC ACID.

Formula: $HC_7H_5O_2=C_6H_5COOH$. Molecular Weight: 121.71.

Synonyms: *Acidum benzoicum sublimatum, Flowers of benzoin, Flowers of Benjamin, Flores benzoes.*

"An organic acid, usually obtained from benzoin by sublimation, or prepared artificially, chiefly from toluol. It should be kept in dark, amber-colored, well-stoppered bottles, in a cool place"—(*U. S. P.*).

Source and History.—Benzoic acid is a characteristic constituent of many balsam-resins. It is contained in benzoin, storax, liquidambar, castoreum, balsams of tolu and Peru, and other resinous bodies. The principal source, however, is from gum benzoin, though on account of the scarcity of benzoin yielding profitable quantities of the acid, Botany Bay resin is often used, and as a rule gives a larger yield than that obtained from true benzoin. There are two kinds of benzoic acid on the market, viz.: English and German. The former is obtained by sublimation of the above-mentioned gums; the latter from the urine of herbivorous animals and from coal-tar products. That made from benzoin only should be used by the druggist and doctor.

Vigenère, as far back as 1608, described benzoic acid as one of the products resulting from the dry distillation of gum benzoin. Lemery (1675), and Scheele, just 100 years later, both recognized it as an acid, and the process of preparation given by the latter is essentially one of the methods used in its production at the present time. It was discovered by Baron Liebig, in 1830, in the products obtained by distilling hippuric acid, and obtained from that acid by the action of acids and alkalies by Dessaignes in 1847.

Preparation.—Several modes of preparing benzoic acid have been given from time to time. We shall only introduce here one dry and one wet method. The dry method, which is essentially that introduced by Mohr and adopted by the Pharmacopœia of the United States in 1870, is as follows: Into an iron dish about 8 or 9 inches wide and a couple of inches deep is introduced about 1 pound of benzoin, broken into coarse fragments or coarsely powdered, spread uniformly over the bottom of the vessel. Over the top of the dish is evenly stretched a piece of coarse filter-paper and pasted to the edges of the container. A hat-like, conical receiver is then made of well-sized paper, a little larger at the base than the diameter of the dish to which it is then attached by pasting it securely over the rim of the vessel. The dish, with its contents, is then placed in a sand-bath and gently heated not higher than 145° C. (293° F.) at the beginning, gradually raising the heat until 200° C. (392° F.) is reached. The vapors of the acid, which are held in combination with the resin, are thus liberated by the heat, and ascending pass through the bibulous paper and condense on the inside of the conical receiver, all empyreumatic oils being absorbed by the paper diaphragm as the vaporous acid passes through it. The heating should be continued 3 or 4 hours or until the acid vapors no longer rise. Should the paper diaphragm become clogged by the melting of the acid in any watery vapor that may be present, it should be removed and a new one inserted in its place. It occasionally happens that by jarring, or by some other means the condensed acid adhering to the receiving-cap becomes detached and falls upon the filter-paper, and thus becomes contaminated with the empyreumatic products held by it and liquefies, thus impeding the further passage of the vapor. Should this occur the fallen portion should be resublimed to rid it of impurities and a new diaphragm introduced. To prevent such an accident a layer or two of gauze or linen may be stretched above the paper division so that any falling particles would be caught by it, thus preventing its reaching the contaminated bibulous paper. A yield of about 7 or 8 per cent is realized by this method. By breaking up the fused mass left in the container and subjecting it again to sublimation an additional quantity may be obtained. An earthenware vessel may be used instead of an iron one, and the mass may be heated on a common stove-plate if desired, but great care should be exercised that the gum be not too strongly heated.

Scheele's wet method consisted in boiling benzoin in water and milk of lime, separating the resulting calcium benzoate while hot by filtration, and precipitating from the solution the benzoic acid by means of hydrochloric acid. The product is sometimes sublimed to give the appearance of the acid made by the dry method. This process yields about 13½ per cent.

A commercial grade known as German benzoic acid is prepared by mixing the urine of horses and cattle with an excess of lime, and evaporating the solution to about one-twelfth of its bulk. The resulting calcium hippurate is then supersaturated with hydrochloric acid, liberating hippuric acid, which is purified by animal charcoal or other means. Hydrochloric acid is then added to the purified hippuric acid and boiled one-half hour, when benzoic acid and glycocoll (CH_2NH_2COOH) result. Benzoic acid obtained in this manner has a fetid, urinous odor, and is purified by recrystallization or by subliming it with a small quantity of benzoin. Benzoic acid is also cheaply produced on a large scale by synthetic methods from naphthalin ($C_{10}H_8$), a derivative of coal-tar, and from tolulol ($C_6H_5CH_3$), one of the products of the distillation of wood and coal and a constituent of commercial benzin. The greater portion of the artificial product is now prepared from tolulol by converting the latter into benzo-trichloride and heating this substance with water under pressure. The following reactions take place: $C_6H_5CH_3+Cl_6=C_6H_5CCl_3+{}_3HCl$. $C_6H_5CCl_3+{}_2H_2O=C_6H_5COOH+{}_3HCl$.

Description and Tests.—"Benzoic acid occurs in commerce in white, or yellowish-white, lustrous scales or friable needles, odorless, or having a slight, characteristic odor resembling that of benzoin, and of a warm, acid taste; somewhat volatile at a moderately warm temperature, and rendered darker by exposure to light. Soluble, when pure, in about 500 parts of water, and in 2 parts of alcohol at 15° C. (59° F.), in 15 parts of boiling water, and in 1 part of boiling alcohol. Also soluble in 3 parts of ether, 7 parts of chloroform, and readily soluble in carbon disulphide, benzol, fixed and volatile oils, but sparingly soluble in benzin. Benzoic acid volatizes freely with the vapor of water. On heating it to

100° C. (212° F.) it begins to sublime. At 121.4° C. (250.5 F.) it melts, and at a higher temperature it is consumed without leaving a residue. The acid sublimed from benzoin has a lower melting point, and a greater solubility in water. Benzoic acid has an acid reaction. On heating benzoic acid gradually with 3 parts of freshly-slaked lime in a retort benzol is evolved. The acid is freely soluble in solutions of alkali hydrates. On carefully neutralizing such a solution, and adding ferric chloride T.S., previously diluted with 2 volumes of water, and neutralized, if necessary, by ammonia, a flesh-colored precipitate of ferric benzoate is produced. A solution of benzoic acid in pure, cold, sulphuric acid, when gently warmed, should not turn darker than light brown; if it is then poured into water the benzoic acid should separate as a white precipitate, and the liquid should be colorless (absence of readily carbonizable, organic matters). If 0.5 Gm. of the acid and 0.8 Gm. of calcium carbonate be mixed with a little water in a crucible, the mixture dried, gently ignited, and then dissolved in water, with the aid of nitric acid in slight excess, so as to obtain 20 Cc. of filtrate, the addition of silver nitrate T.S. to the latter should not produce much more opalescence (if at all) than is produced by the same reagent in a solution measuring 20 Cc. prepared by dissolving 0.8 Gm. of the same calcium carbonate in water with the aid of nitric acid (absence of more than traces of chlorine). On warming 0.5 Gm. of the acid with 5 Cc. of water and 0.5 Gm. of potassium permanganate in a test-tube loosely stoppered and placed in a water-bath heated to about 45° C. (113° F.), then tightly stoppering and cooling the test-tube with cold water, upon removing the stopper no odor of oil of bitter almond should be discernible (absence of cinnamic acid)"—(*U. S. P*).

Benzoic acid is permanent at ordinary temperatures. If made from hippuric acid its appearance is often as fine, if not finer, than when produced from benzoin, but traces of a urinous odor can be detected in it. If the odor of benzoic acid resembles that of the sweat of horses it should be rejected. German benzoic acid is often a pure white, the object in later years having been to make it so that it will resemble that produced from the gum. Formerly the crystals produced by this process (artificially) were much the handsomest. It will be observed that though the Pharmacopœia recognizes both the natural and artificial product its description of the acid is so constructed that it can apply only to the true product produced from the gum, thus practically ruling out the artificial acid. Benzoic acid gives rise to a line of more or less soluble salts known as benzoates.

Action, Medical Uses, and Dosage.—Benzoic acid is destructive to bacterial forms of life, and equally as valuable as salicylic acid in arresting putrefaction. Infusion of gentian, orange, and buchu may be kept unimpaired for a month by the addition of ¼ gr. to the ounce of liquid (Benger). In bulk or in concentrated solution it acts, even in small doses, as a gastro-intestinal irritant, consequently it should be administered in large quantities of water. It excites a general sense of warmth throughout the system, and materially increases the secretions of the skin and pulmonary mucous surfaces. It was formerly used, to a considerable extent, in *broncho-pulmonary affections*. Its principal use now, however, is in disorders of the *urinary tract*. It prevents and corrects ammoniacal and other varieties of *fermentation of urine* in the bladder and renders the fluid more acid. If, however, the urine be excessively acid its use, by dissolving it in water by the aid of a small amount of sodium phosphate or carbonate, renders it less acid and thereby relieves the irritability of the cystic mucous lining. It is a certain remedy for *phosphatic gravel*, and is said to be equally serviceable when *vesical irritability* is due to excess of uric acid. *Cystitis*, when due to excessively alkaline urine, or to a urinous fermentation, purulent or non-purulent, is promptly benefited by this agent. Its action is purely local, and by thus acting as an antiferment it renders good service in *nocturnal enuresis*, *dysuria*, and *urethritis* when due to these fermentative changes. It is a good remedy for *gonorrhœa* when aggravated by ammoniacal or other putrid states of the renal secretions. It prevents the formation of incrustations, or *calculi* of ammoniaco-magnesian phosphate, by maintaining the acid quality of the urine. The *enuresis of children* and *urinal dribbling of old persons*, if due to excessive alkalinity, are greatly benefited by a couple of 5 to 10-grain doses daily. Prof. Scudder recommends it as a specific in "irritation of the sympathetic and spinal system of nerves with uric acid deposits" and as a stimulant for *brain exhaustion* in mentally-overworked individuals, with phosphuria—(*Specific Medication*). It is useful in *rheumatism*, but only in those cases showing markedly alkaline urine. It is believed to exert some influence on *jaundice*, due to obstruction of the bile ducts with inspissated bile, and has restored to its normal condition urine that was loaded with chyle. Benzoic acid reduces the quantity of albumen in *albuminuria*. It is one of the ingredients of paregoric, and is also employed in making many cosmetic washes. The dose ranges from $\frac{1}{10}$ to 30 grains, the moderate doses being preferred to correct excessive alkalinity of the urine.

Specific Indications and Uses.—Excessively alkaline urine; phosphuria; vesical irritability, with alkaline urine; fermentative urine; brain-fag, with phosphuria; "irritation of the sympathetic and spinal system of nerves with uric acid deposits"—(Scudder).

Derivative.—BENZOYL TROPEINE ($C_{15}H_{19}NO_2.2H_2O$). Silky needles obtained by heating to 100° C. (212° F.) a mixture of tropine, benzoic acid, and dilute hydrochloric acid. It melts at 58° C. (136.4° F.); the anhydrous base at 41° to 42° C. (105.8° to 107.6° F.). Its compounds are not readily dissolved. Filehne (1887) found benzoyl-tropeine to effect a powerful local anæsthesia, and like other tropeines the muscles of accommodation and the pupils were affected by it. He also found other compounds of benzoyl to produce local anæsthesia, *benzoyl morphine* being weakest, *benzoyl quinine* more powerful, while *benzoyl triacetonalkamine* was most active in this respect.

ACIDUM BORICUM (U. S. P.)—BORIC ACID.

FORMULA: H_3BO_3. MOLECULAR WEIGHT: 61.78

SYNONYMS: *Boracic acid, Orthoboric acid, Acidum boracicum.*

Source, History, and Preparation.—This acid is found in nature in several species of plants, in the waters of the sea, and such mineral springs as Vichy, Wiesbaden, and Aix-la-Chapelle, as well as in several of the hot springs of America. It is found in nature in minerals, and especially in the niter regions of Chili and Peru, where it occurs as *borocalcite*. As a constituent of natural borax it has been discovered in enormous quantities in Borax Lake, California, and it also occurs in the same natural combination as *tincal* in the dried-up, saline lagoons or lake-beds of Thibet. Owing to the recent development of the borax industry along the Pacific coast, the major part of the boric acid consumed in the United States is now derived from the California deposits, while the greater part of the world is supplied from the extensive natural products from the volcanic rocks of Tuscany and the isle of Volcano, of the Lipari group, north of Sicily, where free boric acid occurs naturally under the name of *sassoline*.

On the volcanic mountain-sides of Tuscany are to be seen innumerable fissures which throw out jets of steam, called *suffioni*, charged with various gases and boric acid. Surrounding one or more of these crevices (also called *suffioni* or *soffioni*) may be seen either a natural basin or lagoon, or one constructed of masonry. Several of these circular lagoons are arranged on the mountain-side and made to connect with each other by a series of canals. Cold water from a mountain spring is then allowed to fill these basins, and receives the steamy vapors which either condense and flow into them, or else shoot up into them from the bottom. These jets constantly breaking into the water heat it and yield to it boric acid. This acid solution is then allowed to pass down the declivity into another lagoon and so on until, by receiving an added amount from each basin, it becomes saturated, when it is conducted into leaden pans, where it is evaporated to such an extent that when drawn off into wooden vats and cooled, it will deposit crystals of crude boric acid. This acid is then shipped to various countries where it is converted into borax either by boiling it with a soda solution, or fusing it with calcined carbonate of sodium. The latter method is usually employed. The medicinal boric acid is then made from the borax so produced. Boric acid was first made by Homberg (1702), after whom it was known as the "sedative salt of Homberg" (*sal sedativum Hombergi*). The medicinal acid may be prepared as follows: Take borax 10 parts, boiling water 24 parts. Dissolve the borax in the water and filter while hot. Mix with the filtrate 6 parts of chlorhydric acid and allow the mixture to stand in a cool place for 24 hours. Collect the resultant crystals upon a strainer or in a funnel, wash them with cold water, and dissolve them again in 5 parts (by weight) of boiling distilled water, and allow the solution to stand for a few days. Re-collect the crystals, wash with cold water to free them from traces of foreign matter, and dry them in a moderately warm situation.

Description.—Boric acid occurs, according to the Pharmacopœia, in "transparent, colorless scales, of a somewhat pearly lustre, or, when in perfect crystals, six-sided, triclinic plates, slightly unctuous to the touch, odorless, having a faintly bitterish taste, and permanent in the air. Soluble at 15° C. (59° F.), in 25.6 parts of water, and in 15 parts of alcohol; also soluble in 10 parts of glycerin. Addition of hydrochloric acid increases its solubility in water. When heated to 100° C. (212° F.), boric acid loses water, forming metaboric acid (HBO_2), which slowly volatilizes at that temperature. Heated to 160° C. (320° F.), it fuses to a glassy mass of tetraboric (or pyroboric) acid ($H_2B_4O_7$); at a higher temperature the fused mass swells up, loses all of its water, and becomes boron trioxide (B_2O_3), which fuses into a transparent, non-volatile mass. From a boiling solution, boric acid readily volatilizes. The solution in alcohol or glycerin burns with a flame enveloped with a green-colored mantle"—(*U. S. P.*).

Boric acid has feeble acid properties. It dissolves in the essential oils. "An aqueous solution (1 in 50) of boric acid colors blue litmus paper red, but yellow turmeric paper brownish-red after drying, even when the solution had been acidulated with hydrochloric acid; this brownish-red color is changed to bluish-black by ammonia water. A 2 per cent aqueous solution of the acid should not be precipitated by barium chloride T.S. (absence of sulphate); silver nitrate T.S. with nitric acid (absence of chloride); ammonium sulphide T.S. (lead, copper, iron, etc.); ammonium oxalate T.S. (calcium); or sodium phosphate T.S. and ammonia water (magnesium). No odor of ammonia should be evolved by heating the acid with potassium or sodium hydrate T.S. In a solution of 1 Gm. of boric acid in a mixture of 1 Cc. of hydrochloric acid and 49 Cc. of water, 0.5 Cc. of potassium ferrocyanide T.S. should not at once produce a blue color (limit of iron). A fragment heated on a platinum wire (thoroughly cleansed by washing and heating until it no longer colors the flame), should not impart to the non-luminous flame a persistent yellow color (absence of sodium)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Though used for the destruction of roaches and other insects, boric acid is generally without any marked action on the higher animals. When absorbed, however, from local applications to raw surfaces, or when injected into the pleural sac of man (5 per cent solution) death has resulted preceded by vomiting, singultus, and collapse, some cases exhibiting general erythema of the skin and diarrhœa, followed by bloody vomiting and increased activity of the kidneys, finally ending in complete renal inaction and death.

Applied to the cutaneous surface boric acid is wholly unirritating, and when an antiseptic and antipyic dressing for *wounds* is demanded it may be used with advantage. It is of value as a dressing for *burns* and *scalds*, a petrolatum ointment being the preferred form. Cloths dipped in a saturated solution may be continuously applied to *dog bites*. Certain *aphthous conditions* are benefited by its local application, and Prof. Locke directs for badly ulcerated *diphtheria*: ℞ Boric acid 1 part; glycerin 30 parts. Mix. Sig. Apply locally. *Ozena* and other forms of *nasal catarrh*, as well as *pharyngitis*, are benefited by it.

Owing to the property of correcting fetor possessed by this drug, it has yielded efficient results in modifying the fetid eructation accompanying *fermentative stomach disorders*, and by its chemical action it corrects excessive alkalinity of the renal secretions resulting in ammoniacal urine and its consequent *cystic irritation*. Mucopurulent secretions, such as accompany *gonorrhœa*, *vaginitis*, *cystitis*, *nasal catarrh*, etc., are in a measure controlled by a solution of this acid. It is also one of the most efficient remedies for *fetid perspiration*, particularly of the axilla and feet. Its main use, however, outside of its application to wounds, has been in ophthalmic and aural practice. Though often an abused drug, if properly used in well selected cases it gives admirable results. It is signally useful in *irritable eyes* with redness and itching, and for the various forms of *conjunctivitis*, with much secretion, it gives excellent results. Where the conjunctival surfaces are thickened and velvety and the secretions copious and watery, the acid in impalpable powder may be dusted upon the parts, though the practice should not be long continued lest unpleasant dryness of the membranes should result (Foltz). *Phlyctenular conjunctivitis* and *corneal ulceration* are well treated in the same manner. For *ciliary blepharitis* an ointment of from 5 to 10 grains of boric acid to 2 drachms of petrolatum forms a soothing and effectual application. The ointment has also been successfully applied in certain *skin affections*. The acid is combined with Lloyd's ergot by Foltz (*Dynamical Therapeutics*) in all conjunctival disorders as follows: From 10 to 30 drops of the ergot are added to a solution of 6 grains of boric acid in 1 fl℥ of water; of this 2 drops are instilled in the eye every 2 or 3 hours. In ear diseases this acid has proved of great service. In *purulent inflammation of the middle ear* with turgid membranes and slight discharge, apply it with ergot; if the membranes be pallid combine it with iodoform; if a moderately profuse, thin, acrid pus be discharged, calendula and boric acid give the best results. For *polypoid growths* and *granulations* it may be combined with salicylic acid and dusted upon the parts. In *otorrhœa* the powder should be frequently dusted upon the parts, and excellent results have attended this procedure. The internal dose of boric acid is from 1 to 15 grains; for external use from a 1 per cent to a saturated solution, according to the parts to which it is to be applied.

Specific Indications and Uses.—*Locally*: Wounds; conjunctival disorders with velvety, thickened membranes and profuse secretion; otorrhœa; fetid perspiration. *Internally*: Fetid eructations, ammoniacal urine.

Related Product.—GLACIALIN. This is said to be a mixture of boric acid (6), biborate of sodium, and sugar of each (3) and glycerin (2) parts, and is employed to preserve foods and is used as an antiseptic.

ACIDUM CARBOLICUM (U. S. P.)—CARBOLIC ACID.

FORMULA: C_6H_5HO. MOLECULAR WEIGHT: 93.78.

SYNONYMS: *Phenol, Phenic acid, Phenylic acid, Acidum phenicum, Acidum phenylicum crystallisatum, Phenylic alcohol, Hydrate of phenol.*

Origin, History, and Preparation.—Carbolic acid was discovered in coal-tar in 1834 by Runge, who gave it the name it now bears. It belongs to the class of phenols, substances closely allied to the alcohols, but having pronounced acid properties. Phenols are those derivatives of aromatic hydrocarbons, such as benzene, naphthalene, etc., in which hydroxyl replaces the hydrogen of the hydrocarbon ring. They form salts with alkalies, which are called phenates, or carbolates, or phenol alkalies, *e.g.*, phenol potassium. The greater portion of the pure carbolic acid now in use comes to us from England and Germany. A large quantity of crude, and some nearly pure phenol is now made within the United States. Commercial carbolic acid is derived from the distillation of the heavy oil from coal-tar, known as *dead oil*, which when heated between 150° C. (302° F.) and 200° C. (392° F.) passes over as a brown oil and is then subjected to two rectifications, the resultant product being *crude carbolic acid* (*acidum carbolicum crudum*, or *impurum*). This product is then converted into sodium or potassium phenol by agitating it with a warm concentrated solution of caustic soda or potash. A solid crystalline mass results from which the supernatant oily liquid, containing hydrocarbons and other impurities, may be poured off. The sodium or potassium phenate is then subjected to a heat of 170° C. (338° F.), and a portion of the empyreumatic impurities is driven off, the remainder being separated by dissolving the salt in 10 parts of water. Hydrochloric acid is then added to supersaturation, upon which the carbolic acid separates in an oily condition. After washing the phenol with a saturated solution of sodium chloride, it is dried over calcium chloride, and distilled. That which distills over between 180° and 190° C. (336° and 374° F.) is then subjected to a low temperature, when crystals are deposited, and after being separated from the adherent mother-liquor, are dried by expression. If further purification is desired, it may again be mixed with an alkali and treated as before. By this process cresol and several other impurities (to which, however, the value of phenol is largely due) are separated.

Prof. Church (1871) proposed the preparation of pure carbolic acid by dissolving the nearly pure commercial crystals in 20 parts of water, by which a portion of it is dissolved, the undissolved portion retaining the foreign matter. Decant or siphon off the clear, aqueous solution, saturate it with sodium chloride when the phenol rises to the top as an oily layer, which may then be freed from its water by distillation with lime, when crystals having a faintly aromatic odor are obtained.

Synthetic Carbolic Acid.—A synthetic carbolic acid is now prepared, and has the advantage of being free from cresols and other homologous products. Benzene-sulphonic acid is first produced by moderately heating a mixture of fuming sulphuric acid and benzene. Neutralization with potassium carbonate then converts the acid into potassium benzene-sulphonate, and this when fused with caustic potash in large excess, yields potassium phenol and potassium sulphite. The phenol is then liberated from the potassium phenol and purified by distillation.

Description.—Carbolic acid occurs in commerce in two forms which are described in the Pharmacopœia as follows:

I. Acidum Carbolicum Crudum (*U. S. P.*). *Crude carbolic acid* (*Acidum carbolicum impurum*).—" A liquid consisting of various constituents of coal-tar, chiefly cresol and phenol, obtained by fractional distillation" (*U. S. P.*). "It is a nearly colorless, or reddish, or brownish-red liquid, of a strongly empyreumatic and creosote-like odor; having a benumbing, blanching, and caustic effect upon the skin or mucous membrane; and gradually turning darker on exposure to air and light. The aqueous solution of crude carbolic acid has a slightly acid reaction on litmus paper. In an aqueous solution of the acid, bromine water produces a white precipitate. Crude carbolic acid should not be soluble in less than 15 parts of water at 15° C. (59° F.), and the aqueous solution should not have an alkaline reaction (absence of alkalies). If 50 volumes of the acid be thoroughly agitated with 950 volumes of water, in a capacious vessel, on allowing the mixture to separate, the undissolved portion should not exceed 5 volumes, or 10 per cent by volume of the acid (limit of other less soluble constituents of coal-tar)"—(*U. S. P.*).

II. Acidum Carbolicum (*U. S. P.*). *Carbolic acid* (*Phenol*).—"A constituent of coal-tar, obtained by fractional distillation, and subsequently purified. Carbolic acid should be kept in dark, amber-colored, well-stoppered vials. Colorless, interlaced, or separate, needle-shaped crystals, or a white, crystalline mass, sometimes acquiring a reddish tint; having a characteristic, somewhat aromatic odor, and, when copiously diluted with water, a sweetish taste with a slightly burning after-taste. Deliquescent on exposure to damp air. Soluble at 15° C. (59° F.), in about 15 parts of water, the solubility varying according to the degree of hydration of the acid. Very soluble in alcohol, ether, chloroform, benzol, carbon disulphide, glycerin, fixed and volatile oils. Almost insoluble in benzin. When gently heated, carbolic acid melts, forming a highly refractive liquid. It is also liquefied by the addition of about 8 per cent of water. If the acid be liquefied by a gentle heat, and then slowly cooled, under constant stirring, until it is partly recrystallized, the semiliquid mass should have a temperature (remaining stationary for a short time) not lower than 35° C. (95° F.). The acid should have a boiling point not higher than 188° C. (370.4° F.). A lower boiling point, or a higher melting point, indicates a purer or less hydrated acid. When heated upon a water-bath, the acid should be volatilized without leaving a residue. The vapor of the acid is inflammable. Carbolic acid is faintly acid to litmus paper. The aqueous solution of the acid yields, with bromine water, a white precipitate which at first redissolves, but becomes permanent as more of the reagent is added, and appears crystalline when viewed under the microscope"—(*U. S. P.*).

Perfectly pure carbolic acid is permanent in the atmosphere, but should the so-called pure product contain a trace of water, then it speedily becomes deliquescent. It dissolves sulphur, resin, and copal, forming with the latter a brilliant varnish that remains soft for many months after its application. It is quite freely soluble in hot benzin. It coagulates blood, collodion, and albumen, produces flakes in milk, and destroys the odor of cheese, rendering it soft and unctuous, and added in small amounts to vegetable juices, prevents or checks fermentation. It combines with the metallic oxides, and reduces several metallic salts, especially those of copper and silver. Its alkaline salts are not very permanent, and have an alkaline reaction; water decomposes its potassium salt; all the soluble carbolates, as well as carbolic acid itself, communicate to pine wood moistened in it, and subsequently dipped in nitric or hydrochloric acid, a black-blue color as it dries. When heated in a sealed tube with ammonia it yields aniline and water. Nitric acid forms picric acid with it. A beautiful orange-colored dye, *aurine*, is made by heating in a glass vessel to 126.6° C. (260° F.) a mixture of carbolic and sulphuric acids, and then slowly and carefully adding to it an amount of oxalic acid nearly equal to the quantity of sulphuric acid used; this having been done, the whole is thrown into cold water, and the resulting green, solid mass is well worked in boiling water to remove all excess of sulphuric acid.

Dr. E. R. Squibb states that pure crystallized phenol or carbolic acid has a sweet and comparatively bland taste, and is nearly odorless, and that the ordinary liquid article of commerce is impure, and owes its azymotic power to another coal-tar principle, *cresol* (see below), which has a smoky, dry, and pungent taste. He is therefore disposed to consider the rejection of cresol in the therapeutical article as objectionable, and would prefer the impure article (the commercial liquid carbolic acid, or coal-tar creosote) in cases where the azymotic and antiseptic effects are required (*Amer. Jour. Pharm.*, May, 1869, p. 259). Carbolic acid when pure remains clear; but when its homologues are present, *e.g.*, cresol, it becomes colored, as with the fluid carbolic acid of commerce. Fabrini asserts that this coloration is caused by the formation of *phenerythen*, a coloring principle, organic in character, and produced by metallic particles suspended in the phenol. This pink, or reddish color, is especially apt to occur in the commercial product on exposure to light and air. This, however, does not impair its medicinal qualities. Carbolic acid is largely employed in fluid form, made by adding to the crystals from 5 to 10 per cent of water, when they readily liquefy and remain fluid. A convenient method is to combine equal parts of carbolic acid and glycerin, which mixture is readily soluble in water in all proportions. Dilute solutions of carbolic acid have a sweetish, smoky taste, followed by a slightly burning sensation. Phenol is largely consumed in the synthetic process of producing salicylic acid and other synthetic compounds, and is extensively employed in the making of dye-stuffs. The pure acid in crystals may be rendered fluid by placing the vial holding it in hot water, being careful, however, to guard against breaking the bottle. The odor of carbolic acid renders it very objectionable with many, but this may be overcome by adding a few drops of oil of lemon to it.

Tests.—"On adding to 10 Cc. of a 1 per cent aqueous solution of the acid, 1 drop of ferric chloride T.S., the liquid acquires a violet-blue color, which is permanent; and on adding carbolic acid either to albumen or to collodion, coagulation takes place (difference from creosote). One volume of cold, liquefied carbolic acid (rendered liquid by the addition of 8 per cent of water) forms, with 1 volume of glycerin, a clear liquid which is not rendered turbid by the addition of 3 volumes of water (absence of creosote or of cresylic acid). If 0.039 Gm. of carbolic acid be tested by the method immediately following, there should be required for its complete conversion into tribromophenol not less than 24 Cc. of decinormal bromine V.S. (each Cc. of the volumetric solution corresponding to 4 per cent of absolute phenol)"—(*U. S. P.*).

"Valuation of Carbolic Acid.—Dissolve 1.563 Gm. of carbolic acid to be valued, in a sufficient quantity of water to make 1000 Cc. Transfer 25 Cc. of this solution (containing 0.039 Gm. of the acid) to a glass-stoppered bottle having a capacity of about 200 Cc. add 30 Cc. of decinormal bromine V.S. (which is 5 Cc. more than would be required if the carbolic acid in solution were absolute phenol, the excess being added to promote the formation and separation of tribromophenol), then 5 Cc. of hydrochloric acid, and immediately insert the stopper. Shake the bottle repeatedly in the course of half an hour, then remove the stopper just sufficiently to introduce quickly 5 Cc. of a 20 per cent aqueous solution of potassium iodide, being careful that no bromine vapor escape, and immediately stopper the bottle. Shake the latter thoroughly, remove the stopper and rinse it and the neck of the bottle with a little water, so that the washings may flow into the bottle, and then add, from a burette, decinormal sodium hyposulphite V.S., until the iodine tint is exactly discharged, using towards the end a few drops of starch T.S. as indicator. Note the number of Cc. of decinormal sodium hyposulphite V.S. consumed. Deduct this from 30 (the number of Cc. of bromine V.S. originally added), and multiply the remainder by 4. The product will, approximately, represent the percentage of absolute phenol in the carbolic acid tested"—(*U. S. P.*).

Action and Toxicology.—Carbolic acid is destructive to insects and the lower forms of life. Locally applied to the skin of man it produces a burning sensation, followed by numbness, its continued action being anæsthetic. A peculiar whitish eschar is formed, which eventually becomes brown, and may terminate in a slough. To the taste it is hot, pungent, and sweetish. By coagulating the albumen of the tissues it produces, when swallowed accidentally or with suicidal intent, corrugated, whitish patches upon the lips, fauces, œsophagus, orifices, and folds of the stomach. It readily diffuses itself into the blood, producing pronounced effects upon the nervous system, as vertigo, pallor, and pupillary contraction. The circulation becomes feeble, the pulse either very rapid or abnormally slow, and breathing is impeded. Fatal results have been produced by injections of even weak solutions of this acid into the serous cavities, and many cases of death are on record produced by absorption from dressings of carbolic acid applied to open wounds. When a fatal dose has been swallowed the individual quickly becomes profoundly unconscious, the skin is cold and livid, breathing becomes stertorous, the heart's action gradually grows feebler, and death ensues from respiratory paralysis. Vomiting is sometimes produced in man, and convulsions occasionally. Carbolic acid is principally eliminated by the kidneys, and the dark coloration of the urine produced by it should be a signal to stop its administration. Constant phenomena of poisoning by this agent are a minutely-contracted pupil, and the dark, greenish, blackish, or smoky hue of the urine. After death the blood shows imperfect coagulability.

Carbolic acid poisoning is antidoted by solution of sodium sulphate (Glauber's salt). All the soluble sulphates are chemically antagonistic. Albuminous and demulcent drinks should be freely administered and the stomach-pump employed. In cases of corrosive poisoning emetics should not be employed where the tissues are much destroyed, on account of the danger of rupturing the stomach. The stomach-pump is preferable. Atropine, carried to the extent of maintaining dilatation of the pupils, is said to be physiologically antagonistic, and should be employed to prevent collapse. Saccharate of lime, probably one of its best antagonists, may be used as a chemical antidote if sulphate of sodium is not at hand. Oils should never be given, as they increase the solubility of the poison. On the other hand, some recommend olive oil until the patient vomits. Or after the use of the stomach-pump it is advised to administer freely of olive or sweet almond oil, to which a little castor oil has been added. A mixture of flour and water and soap are recommended highly as simple antidotes. Solution of sodium or magnesium sulphate should be continued in small doses for several days to antidote any remaining traces of the acid.

Among other toxic symptoms the following may present: strangury, stupor, vertigo, tinnitus aurium, deafness, formication, profuse perspiration, frothy salivation, a reduction of temperature, a characteristic intoxication and general anæsthesia. The fatal dose of carbolic acid is not known. A six-months' old babe was killed by a quarter teaspoonful of the glycerin solution (1 to 5). An adult has been killed by 80 grains, while again individuals have recovered from large doses —6 drachms (30 per cent) in one case and 1½ ounces of the solution in another. The time necessary to kill ranges from 3 minutes to 4 hours.

Medical Uses and Dosage.—Carbolic acid is an antiseptic and azymotic, being a violent poison for vegetables and inferior organic bodies; it checks fermentation, prevents the formation of mold in vegetable infusions or juices, and preserves animal tissues from decomposition. It exerts an escharotic influence upon animal tissues when applied, undiluted, producing considerable pain, followed after a time by a white appearance of the part, severe inflammation, and after 15 or 20 days, by an exfoliation of the epidermis. It should never be employed in an undiluted state for ordinary use. But as a caustic, acting superficially, it may be used in *indolent* or *gangrenous ulceration*, *hemorrhoids*, *fistula in ano*, *syphilitic* and other *warts*, *soft chancre*, *carbuncle*, and rarely in *diphtheria* and *malignant sore throat*. Its antiseptic power renders it very valuable as a local application in surgical cases accompanied with purulent, offensive, or other discharges; it is also said to facilitate the healing of *wounds* by the first intention. Two to three parts of carbolic acid to 100 parts of water, applied to *necrosis*, *gangrenous* and other *ulcers*, modifies the suppuration and favors cicatrization. The cases to which it is best adapted are those in which the tissues are full and relaxed. It is contraindicated, as a rule, where the parts are dry, shrunken, or contracted. It is particularly applicable, as a local application, to gangrenous parts where the debilitation is dependent upon diabetes or chronic alcoholism. As a stimulating and deodorizing ointment for *old sores* and *ill-conditioned ulcers*, Prof. Locke recommends: R Carbolic acid ℥i; basilicon ointment ℥xvj. Mix. Apply. Its principal use, however, has been in the treatment of certain cutaneous affections, especially those due to, or accompanied with, animal or vegetable parasitical formations, as in *pediculi*, *scabies*, *eczema*, *lepra*, *impetigo*, *tetter*, *pityriasis*, *lichen*, *psoriasis*, *erythema*, *dermatitis*, etc., in which cases it is used in combination with glycerin. 1 part of acid to 4, 6, 8, or more parts of glycerin. A very excellent application for several cutaneous affections is 1 part of carbolic acid to 4 parts of acetic acid and 15 parts of water. A weak solution of the acid in water forms an excellent topical agent for itching, whether due to *urticaria* or the skin affections above noted, to jaundice or to the parasitic skin affections. In fact, it is particularly useful in *scabies*, *ringworm*, and *tinea versicolor*, *favus* and "*barbers' itch.*" Prof. Bloyer states that he has never failed to cure the latter trouble with it. If desirable to combine it with sulphur he recommends the following: R Carbolic acid gr. v.; sublimed sulphur ʒss; camphor gr. x; ung. zinci ox. ℥i. Mix.

A dilute aqueous solution of carbolic acid (about 1 to 200) employed as an injection will destroy *worms* in the rectum; and injected into the vagina has proved beneficial in *leucorrhœa*, *vulvitis* in the young, *endometritis*, *blenorrhœa*, *gonorrhœa*, *gleet*, *fœtid discharges*, and *ulceration of the os uteri*. A solution of from 2 to 5 grains to a fluid ounce of water, injected into the urethra, has cured *gonorrhœa*. It has proved decidedly useful in *boils*, *whitlows*, and *abscesses*, injecting it into the cavity of these after the pus had been discharged. Care must be had not to poison by absorption. For the purpose of anæsthetizing *abscesses* it may be applied to the crown of the lesions, when the pent-up pus may be painlessly liberated and at the same time deodorized. An excellent treatment for *malignant pustule* or *carbuncle* is to first anæsthetize the surface, and then incise and thoroughly curette the cavities, and finally destroy the remaining slough by another immediate application of the acid. This treatment is said to give but little pain and no shock, and is attended with neither hemorrhage nor putrid absorption. *Hydrocele* and *hemorrhoids* have been treated by injecting from 15 to 20 minims of a 25 per cent solution. For the former thuja is better, while for the second carbolic acid yields as fair results as other injection-fluids. As a post-partum vaginal douche carbolic acid is largely employed by midwives and by many physicians.

In chronic *purulent conjunctivitis* a solution of equal parts of carbolic acid and glycerin, applied to the palpebral conjunctiva, has promptly arrested the disease. An ointment (carbolic acid grs. xij to petrolatum ʒii) has been serviceable in *trachoma*, and the *ulcers* attending *traumatic keratitis* may be cauterized with this acid. A 2 per cent solution is effectual in *ophthalmia neonatorum*, though not so safe as boric acid, and the pure acid applied to the stump after *evisceration of the eye-ball* appears to relieve the pain and stop hemorrhage (Foltz). *External otitis* with much swelling may be treated with a tampon soaked in the glycerin solution (1 in 10) to relieve the pain and reduce the swelling, while in *tympanic hyperemia*, without effusion, the 15 per cent glycerin solution gives marked relief from pain. A solution of the acid in water, used as a wash immediately following coition, is supposed by many physicians to effectually prevent any consequent chancre. One part of carbolic acid to 100 parts of water, injected into the bladder, has been successful in *cystitis*, in which from prostatic hypertrophy or urethral stricture the urine putrefies in the bladder with formation of zoophytes, Penicillium glaucum, etc. In *burns* and *scalds* carbolic acid affords immediate relief, also in *bites* and *stings of insects*. In these accidents it has been neglected. One part of the acid to 6 or 7 or even 16 parts of olive oil, applied with lint, and covered with tin-foil or oil-silk, will be found very useful in cases of severe burns or scalds.

Locally applied pure carbolic acid destroys *warts* and *condylomata*, and is of some benefit in *cancerous affections*. The glycerin solution (1 in 4), or equal parts of the acid and glycerin, may be applied to *uterine cancer* to relieve pain and control fetor. That strength should be used which best controls pain. In *epithelioma* it has been used full strength to destroy the growth. Warm the crystals to deliquescence and thoroughly apply to the bottom of the growth with a pine pencil. For *rodent ulcers*, *poisoned wounds*, and *phagedenic chancre* it may be used full strength, while to *indolent ulcers* and *bubo* the glycerin solution (1 in 4) should be applied. *Toothache* from decayed teeth with exposure of the nerve pulp is quickly relieved by inserting the acid upon cotton into the cavity of the tooth and retaining it there.

An inhalation of carbolic acid is of value in *pulmonary gangrene*. As a 5 per cent spray it may be serviceable in *coryza*, *putrid bronchorrhœa*, *influenza*, *nasal catarrh*, *ozena*, *ulcerated sore throat*, *chronic pharyngitis*, *pertussis*, *chronic bronchitis*, and has even been recommended in *phthisis pulmonalis* as an auxiliary means of treatment; for this latter purpose a grain or two to an ounce or two of water is the strongest solution that should be used. Its use must be discontinued if faintness, giddiness, or trembling, with a weak pulse, should follow its inhalation. It is in some of these conditions that *Dobell's solution* (which see) containing this acid has such a wide application. *Offensive breath* arising from oral, faucial, or dental troubles or from diphtheria is corrected by this agent. It has proved very valuable in dissections, the difficulty of preserving the subject being effectually overcome by injecting carbolic acid mixed with water, and it does not materially affect the appearance of the tissues. One drachm of carbolic acid dissolved in 1 fluid drachm of alcohol and 2 fluid ounces of water, and sprinkled around a sick chamber by means of a spray instrument or otherwise, will be found a valuable disinfectant. Altogether it is a very efficient and valuable remedy, and in all cases the greatest dilution possible should be used that will have the desired effect, that the danger of toxic symptoms from absorption may be avoided.

Internally, pure, crystallized carbolic acid has been advantageously employed in *obstinate vomiting*, in *sarcinæ ventriculi*, *gastric pain* following meals, *flatulency*, *diarrhœa* from eating articles causing fermentation, *scarlatina anginosa*, *typhoid fever*, low grades of *pneumonia*, *bladder diseases*, *cholera*, *cholera morbus* and *cholera infantum*, *tapeworm*, and *diabetes* dependent upon liver disorders, *offensive breath*, etc. It is not, however, to be indiscriminately used, and is always contraindicated by a pinched and contracted condition and where the tongue is dry, long and pointed. It is specifically applicable (as pointed out by Prof. Scudder) where the tongue is broad and moist and the odor putrescent or cadaverous. On the whole it is none too desirable as an internal remedy, but when so administered the dose should be small. ℞ Glycerin solution of carbolic acid (1 in 5), gtt. v to xxx; aqua fl℥iv. Mix. Dose, a teaspoonful every 2 or 3 hours. The dose of the glycerin solution of carbolic acid (carbolic acid 1 part, glycerin 4 parts) is from 1 to 10 drops well diluted. One drop, largely diluted, is the usual dose of pure carbolic acid. Locally any attenuation to full strength as indicated.

Specific Indications.—*Internal use*: "A broad, moist tongue; there is a cadaverous odor of the breath." *External use*: "Fullness and relaxation of tissues; whenever there is retraction, shrinking, and dryness it will prove harmful"—(Scudder).

Related Compounds and Preparations.—Liquefied Phenol. Carbolic acid, to which 10 per cent of water or glycerin has been added, the former being more generally preferred.

Phenol Water, *Carbolized water*.—There are several formulæ for the preparation of *aqua carbolisata*. The *German Pharmacopœia* directs a solution of carbolic acid (liquefied), 33 parts, in distilled water, 967 parts, thus containing about 3 per cent by weight of the pure acid. The *French Codex* directs two carbolated waters, one for internal use containing 0.1 per cent of phenol, and one for topical use containing 1 per cent. Used chiefly as a gargle and as a lotion in *skin diseases*.

Sulpho-Carbolic Acid, *Sulphonic acid*. *Aseptol*, *Sozolic acid*, *Sulphophenol*, *Orthophenol-sulphonic acid*. Formula: $C_6H_4.OH.SO_3H$. Molecular weight: 173.64. Density: 1.45. Two or more sulphophenols result from the interaction of sulphuric and carbolic acids. The ortho-compound may be produced at a low temperature; the para-compound at a high heat. Sulphophenol forms small needle crystals, which are deliquescent, but is usually found as a heavy, syrupy fluid, of an amber or reddish color, and an odor recalling that of phenol. Water, glycerin, and alcohol dissolve it. *Commercial aseptol* contains about 33 per cent of the ortho-acid, and is a sub-caustic liquid of a pale-yellow color. This drug has been used chiefly as an antiseptic in *eye, skin*, and *bladder diseases*. Benefit is said to be derived from its administration in *pharyngitis* and *laryngitis* of a diphtheritic character. It is recommended to be given largely diluted. It has been locally employed in *pyorrhœa* and in *gingivitis*, using from 1 to 8 or 10 per cent solutions.

Lister's Catgut Ligatures, *Carbolated catgut*.—Preserved in carbolated olive oil (1 part of phenol to 5 parts of oil). This is prepared by immersing catgut (200 parts) in a freshly-prepared mixture of phenol (200 parts) and a weak solution of chromic acid in water (1 part in 4000). The catgut should be macerated 48 hours and then placed in the carbolated oil.

Chlorphenol, *Monochlorphenol, Chlorophenol*.—Formula: $C_6H_4Cl.OH$. This very volatile liquid is prepared by acting upon carbolic acid (phenol), at a very low temperature, with chlorine gas. It was originally introduced from Italy as a remedy for *tubercular phthisis*. It is heavier than air, yet volatilizes with great ease, and so penetrating are its dense fumes that the pulmonary air passages are readily filled by them. Antiseptic, as well as antitubercular properties are attributed to it. It is usually employed by inhalation, and has been used in *tubercular troubles, ozena, bronchitis, laryngitis*, etc. Locally, *discharging ulcers, wounds*, and *glands* have been treated with it. An inhalation preparation has been employed, consisting of an alcohol-eugenol-menthol mixture 3 parts, chlorophenol 7 parts. From 10 to 30 drops are to be daily inhaled.

Pheno-salyl.—This is thought to be a mixture formed by melting together 9 parts of phenol, 2 parts of lactic acid, 1 part of salicylic acid, and $\frac{1}{10}$ part of menthol, the latter being added just as the acid liquefies. It is claimed for this preparation that its antiseptic qualities far exceed those of phenol or of salicylic acid. It was introduced by De Christmas.

Acidum Carbolicum Iodatum (N. F.), *Iodized carbolic acid* (*Phenol iodatum, Iodized phenol*).—*Formulary number*, 4: "Iodine, reduced to powder, 20 grammes (20 Gm.) [309 grs.]; carbolic acid, 60 grammes (60 Gm.) [2 ozs. av., 51 grs.]; glycerin, 20 grammes (20 Gm.) [309 grs.]. Introduce the iodine into a flask, add the carbolic acid, previously melted, then the glycerin, and digest the mixture at a gentle heat, frequently agitating, until the iodine is dissolved. Keep the product in glass-stoppered vials in a dark place"—(*Nat. Form.*).

Carbasus Carbolata (N. F.), *Carbolized gauze*.—*Formulary number*, 17: "Resin, in coarse powder, 40 grammes (40 Gm.) [1 oz. av., 180 grs.]; castor oil, 5 grammes (5 Gm.) [77 grs.]; carbolic acid, 10 grammes (10 Gm.) [154 grs.]; alcohol, 225 grammes (225 Gm.) [7 ozs. av., 410 grs.]; gauze muslin, a sufficient quantity. Dissolve the resin, castor oil, and carbolic acid in the alcohol. Immerse in the mixture loosely folded pieces of gauze muslin, allow them to become thoroughly saturated, then take them out and press out the excess of liquid until the weight of the impregnated gauze amounts to one hundred and seventy grammes (170 Gm.) [6 ozs. av.] for every one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.] of the original fabric. Spread out the pieces horizontally, and, as soon as the alcohol has nearly all evaporated, fold and wrap the pieces in paraffin paper, and preserve them in air-tight receptacles. The impregnated gauze, when dry, contains about 2.5 per cent of carbolic acid. *Note*.—The most suitable brands of gauze muslin, for making carbolized or other antiseptic gauze, are those known in the market as 'Stillwater' or 'Lehigh E'"—(*Nat. Form.*).

Acidum Phenylo-boricum, *Phenylo-boric acid*.—This white powder is said to be a powerful germicide, preventing putrescence in less than a 1 per cent solution. It is very sparingly dissolved by water. Locally, it has been used on *venereal sores*, and is reputed active against the *cholera* and other like *bacilli*.

Boro-phenol.—A combination of phenol and borax, having a not unpleasant odor, and wholly dissolved by water. To be used as a disinfectant in all cases in which phenol is useful.

Trichlorphenol ($C_6H_2Cl_3OH$).—This is the chief substance produced when chlorine is made to act upon carbolic acid. It forms in needle crystals readily soluble in alcohol and ether. A glyceride containing from 5 to 10 per cent of trichlorphenol has been painted twice daily on an *erysipelatous eruption*, with asserted benefit. Laurent discovered this body, and Yurinsky, of St. Petersburg, introduced it into medicine.

Cresols (C_7H_8O) or ($C_6H_4CH_3OH$).—The cresols may be obtained by the interaction of caustic potash and toluene sulphonic acid, though they are most generally obtained from that coal-tar distillate which passes over between 200° and 210 C. (392° and 410° F.). They are present also in beech-wood tar, and when present in carbolic acid, as they often are, the boiling point of the latter is raised, while the fusing point is lowered by them. Theory indicates the existence of three cresols, viz.: *ortho-cresol, meta-cresol*, and *para-cresol*. The second is a dense liquid; the other two form colorless, prismatic crystals possessing the odor of phenol. The second has a boiling point at 201° C. (393.8° F.), but even at a very low temperature, —80° C. (—112° F.), does not become solid. The first fuses at 31° (87.8° F.), has a boiling point at 185° C. (365° F.), and is converted into salicylic acid by long continued heating with caustic potash. The third has its fusing point at 36° C. (96.8° F.), and its boiling point at 198° C. (388.4° F.), and if heated with potassium hydroxide becomes paroxy-benzoic acid. None of these forms possess toxic qualities to the extent of that possessed by carbolic acid, and all of them have powerful disinfectant properties and are destructive to low forms of life. Cresol (cresylic acid) has greater antiseptic properties than phenol (Delplanque), and diffused in the sick room has a palliative effect in *whooping-cough*. Several derivatives or compounds of the cresols are now employed, chiefly as external remedies. Of these may be mentioned the following:

1. Lysol.—This product contains cresols to the extent of about 50 per cent, and is said to be produced by boiling tar-oils with fats and alkalies, or saponifying them with alcohol. It

is a transparent, brown, oily-appearing fluid, having a faintly aromatic or creosotic odor. Its density is 1.042. It is dissolved by alcohol, glycerin, chloroform, benzin, carbon disulphide, and water, with the latter forming a clear solution, producing a soap-like frothiness. Its saponaceous character causes it to impart a slipperiness to instruments immersed in it, thus making them difficult to handle. Though much stronger than carbolic acid, it is far less poisonous. It is largely employed in surgical and gynecological practice for its general antiseptic effects, as well as in various skin disorders, *lupus* in particular. It has been proposed as a gargle for *offensive breath* and as a local application to *diphtheritic ulcerations*. It has been employed in conditions presenting *mucorrhœa*, as *leucorrhœa*, *gonorrhœa*, *nasal discharges*, *cholera morbus*, *dysentery*, etc. Sick-room utensils and surgical appliances are deodorized and disinfected by it. For local application a 1 to 5 per cent solution is directed; for internal administration solutions of ½ of 1 per cent are employed.

2. Saprol.—This is an inflammable mixture of the cresols in crude condition, together with petroleum, hydrocarbons, and pyridine bases. Even in 1 per cent solution it is said to be a powerful antiseptic.

3. Creolin.—Creolin is a deep-brown, syrupy fluid having an alkaline reaction and a density ranging from 1.040 to 1.080. It is obtained from coal-tar by freeing the latter of its carbolic acid. It mixes in all proportions with absolute alcohol, fixed oils, and chloroform, is not dissolved by wood alcohol, and when mixed with water a milky, turbid liquid is produced. There are two chief preparations of creolin on the market, Pearson's (from England), and Artmann's (from Germany). The former is perfectly soluble in ether and in the cold, and particularly in the presence of ice, deposits naphthalene in hard, white crystals; the second is but sparingly soluble in ether, and contains less phenol than the English product. Both contain phenols in combination with soda, by the means of which the hydrocarbons present are probably held in solution. Pearson's contains 60 per cent of hydrocarbons; Artmann's 85 per cent. While these preparations are considered non-toxic, it is nevertheless true that poisonous symptoms, and even death have been attributed to their use, even in small amounts. A 2 per cent solution is charged with causing death when used as a post-partum intra-uterine douche, and 30 drops by mouth is said to have caused in an infant inflammation of the glottis, followed by death. In excessive doses it has produced unconsciousness, vomiting, and thirst, but no pain, and the urine was bloody and albuminous, with the odor of carbolic acid. Scarlatinoid and eczematous eruptions have been produced by it. A 2 per cent solution in doses of a drop or two produces a burning sensation in the mouth and naso-pharynx. It is, however, said to be a very effectual deodorizer—even of more value than carbolic acid. Hard rubber and gutta percha are attacked by it, while such effects are not apparent on metallic instruments, though all instruments are rendered slippery and difficult to handle when immersed in its solution. It checks in a measure *ammoniacal fermentation of the urine*, and in a ½ per cent solution has been used to wash out the bladder in *ammoniacal cystitis*. A 1 to 2 per cent solution as a wash or on gauze compresses, is reported effectual in subduing pain, checking bleeding, and limiting suppuration. Fermentative changes are checked by it. *Putrefaction* from retained placenta, etc., has been evercome by from 1 to 2 per cent solutions locally, though as before stated, death is reported to have resulted from its use as an intra-uterine douche. It may be applied on a vulvar compress to deodorize puerperal discharges. *Gangrenous* and other *foul ulcers*, *wounds*, etc., may be dressed with a weak solution, though the healing of open, fresh wounds is said to be somewhat retarded by it. Skin affections, such as *impetigo*, *eczema*, etc., have received benefit from the ointment (2 per cent), while a solution of 1 part of creolin in from 10 to 20 parts of alcohol is recommended for *parasitic skin diseases*. *Leucorrhœa*, *gonorrhœa*, *acute* and *chronic dysentery* are benefited by injections of a weak solution, while a spray (1 in 500) has given fairly good results in *follicular tonsillitis*. *ulcerations of the pharynx*, and fetid conditions of the nasal passages. The *cough of consumption* has been somewhat palliated by such atomization. It has been used in ear and eye affections, but such a procedure is not to be commended, and it is specially contraindicated in keratitis with involvement of the iris and in chronic conjunctivitis. The internal use in *gastro-intestinal disorders* with fermentation, has received some praise. The internal doses are from 1 to 5 minims, preferably in capsules; externally, an aqueous mixture, ointment, and gauzes of from 1 to 2 per cent strength.

4. Sozal, *Aluminum sulphocarbolate* ($Al_2[C_6H_4OHSO_3]_6$) so-called, is produced by the union of paraphenol-sulphonic acid with aluminum as the base. It may be directly prepared by acting upon aluminum hydroxide with phenol-sulphonic acid. It occurs as a granular powder composed of aggregations of small crystals. To the taste it is very astringent, and has a faint odor of carbolic acid. Water, alcohol, and glycerin dissolve it, forming permanent solutions. It is employed where an astringent possessing antiseptic properties is required.

5. Solutol.—A sodium cresylate solution of cresol, one-fourth of which is in a free condition, the remainder being in combination with sodium. Solutol is a powerfully disinfectant and anti-putrefactive agent, being used for disinfecting water-closets, excrements, bedding, sputa, etc. It has caustic properties, and is said to be useful as an anatomical preservative.

6. Solveol.—A concentrated, neutral, aqueous solution of cresol prepared by the intervention of sodium cresotinate. It has scarcely any odor, and is considered superior to carbolic acid as a disinfectant, being about 4 times as active. It is not caustic, and is free from the greasiness which some of the other cresol compounds, such as lysol and creolin, possess. One-half per cent solutions of it scarcely irritate. It is used locally, being well adapted for surgical purposes.

ACIDUM CARBONICUM.—CARBONIC ACID.

Formula: CO_2 OCO. Molecular Weight: 43.89.

Synonyms: *Anhydrous carbonic acid, Carbonic anhydride, Carbon dioxide, Carbonic acid gas.*

Source and History.—Carbonic acid gas (the so-called carbonic acid) was observed in mineral waters as early as 1597, by Libavius, who regarded it as a *volatile spirit;* Von Helmont (1577–1644) called it *gas sylvestre;* Hoffman, who noticed its acid properties in natural combination in mineral waters, named it *mineral spirit;* Lavoisier in 1775 determined its composition. In former times this acid was also known as *fixed air, acid vapor*, and *aërial acid.* Carbon dioxide is a constant factor in atmospheric air to the amount of about .04 per cent. It is given off by the lungs in respiration and by the skin in perspiration, and taken up by plants in the process of "plant respiration." It is always formed during the combustion of organic matter, or carbon; it is also a product of vegetable decay, fermentation and decomposition of organic bodies. It is formed also by calcining the native carbonates (as in the making of lime) and by the action of acids on carbonates. It is apt to form in the cellars of breweries and other places where large quantities of organic matter are undergoing fermentation. It exists in combination in many minerals and also in many mineral springs. The German Spring at Nauheim is said to liberate 3000 pounds of carbon dioxide daily. It is one of the constituents of the deadly "*choke damp*" of the mines.

Preparation.—Carbon dioxide is prepared on a large scale by treating native carbonates, such as marble, etc., with diluted sulphuric acid. For laboratory purposes it may be conveniently prepared by treating pieces of marble with diluted chlorhydric acid.

Description.—Carbonic acid, so-called, is not strictly an acid, but is rather to be considered as carbonic anhydride, which, when combined with a molecule of water, forms carbonic acid (H_2CO_3). Thus: $CO_2+H_2O=H_2CO_3$. True carbonic acid (H_2CO_3) does not exist in a free condition, but is usually found in combination with water, as in mineral springs, and by its combination with bases gives rise to the native carbonates, the calcium carbonate especially forming the backbone of the earth. It is a weak, bibasic acid. The acid carbonates (bicarbonates), liberate carbon dioxide when heated. Soda water, the summer beverage, is a solution of carbonic acid (H_2CO_3) in water (see *Aqua Acidi Carbonici*).

Carbon dioxide (CO_2) or *carbonic anhydride*, is an invisible, irrespirable gas, having a faint odor and a sharp, slightly acidulous taste. Its specific gravity is 1.5245, and it is so much heavier than air that it may be poured from one vessel to another; it slightly and transiently reddens litmus; is not combustible, extinguishes most burning bodies, and is reduced to a limpid, colorless liquid under a pressure of 36 atmospheres 0° C. (32° F.), which is practically insoluble in water and in fat oils, but is soluble in all proportions in alcohol, ether, oil of turpentine and carbide of sulphur. When the pressure is removed from the liquid carbonic acid the cold produced by the evaporation of one part is so great that another part freezes, forming a white, snow-like body (solid carbonic anhydride), which is a bad conductor of heat, and has the temperature —64.4° C. (—83.9° F.). Mixed with ether and placed under the exhausted receiver of an air pump, Faraday obtained a temperature of 74.4° C. (166° F.). The metallic, alkaline, and earthy salts formed with carbonic acid are called carbonates. If a light be introduced into a well, pit, mine, or other place, it will burn dimly or be extinguished if this gas be present, and the air of such place will certainly destroy life if respired. The sparkling and effervescing properties of many kinds of wine, beer, cider, mineral waters, etc., are owing to the presence of carbonic acid gas. When carbon dioxide has accumulated in cellars or other places, so as to render them fatal to animal life, it may be removed by sprinkling about some *aqua ammoniæ;* this combines with the carbonic acid to form carbonate of ammonium, and fresh air rushes in to fill up the space produced by the condensation of the acid.

Action and Medical Uses.—Carbonic acid gas is a narcotic poison inducing cerebral congestion and apoplexy (Taylor). To respire the pure acid is impossible, asphyxiation at once taking place. Diluted with air it is more or less respirable. According to Demarquay, air containing 25 per cent of carbon dioxide may be respired with but little discomfort; according to others, such proportions would be extremely dangerous. Water impregnated with this gas produces a pungent, prickly sensation in the mouth, nose and fauces, warmth in the stomach, and for a brief time cerebral excitation. Gastric eructations take place, and the gastric secretions are augmented and digestion stimulated. Sensibility of the skin is obtunded in a limb exposed to the gas. Immersion of the body, the head being free, into this gas induced successively prickling and heat of the surface, redness and sweating, quickened heart action, which was afterward retarded, throbbing in the head, dulling of the senses, difficult breathing, borborygmi and colicky pains. Inhaled in toxic quantities, besides some of the symptoms already observed there is a sense of constriction, oppression of the breathing organs, weight in the head, and pressure in the temples, headache, dizziness, singing noises in the ears, tendency to somnolence, great muscular weakness, the patient falling and unable to escape, unconsciousness, the breathing becomes stertorous, then ceases, as does the heart, which at first beats violently. A relaxed and flexible state of the limbs (occasionally rigid, and rarely convulsed) remain, as well as bodily warmth, though the patient appears dead. The countenance is usually leaden-hued, particularly about the mouth and eyes, though occasionally pale and placid, and death ensues. When one recovers, pain and soreness of the body and head remain for many days, while facial paralysis supervenes in some cases. When the amount of gas is great the person is suddenly prostrated and insensible, dropping where found, and totally unable to escape. Death quickly follows unless promptly removed to fresh air.

Carbonic acid gas has been used with success in *scrofulous ophthalmia*, being directed upon the affected part in a small jet; it has also been directed upon the uterus and upper part of the vagina in *dysmenorrhœa* and *ulceration of the cervix*; passed into the rectum it has been found useful in *ulceration of the rectum* and *dysentery;* and in *cancerous* and other *ulcers* it forms a good application. This effect is due to its anæsthetic action. The jet should be continued from 3 to 10 minutes upon the affected part, repeating it 4 or 5 times a day. Formerly, *phthisis*, and *diseases of the bronchiæ* and *larynx* were treated by inhalation of this gas, and it has more recently been employed with asserted success in allaying the suffering and cough in *laryngeal phthisis* and in *whooping-cough*. It formed the basis of the Bergeon (1888) treatment for *phthisis*, a current of the gas being passed through a sulphuretted mineral water twice daily into the rectum, resulting, according to its author, in the prompt alleviation and suppression of all of the active phases of pulmonary consumption. This treatment scarcely attained any popularity with the profession. Iced, effervescing draughts are very serviceable in *obstinate nausea* and *vomiting* due to an irritable stomach. *Flatulence* is relieved by it, and saline medicines are retained by the stomach when administered in the carbonated waters. Undoubtedly the ease and comfort derived from the yeast poultice and other similar applications are due largely to the anæsthetic virtues of the liberated gas. Recent *burns* are said to be promptly soothed and rendered painless by this gas. In accidents arising from its inhalation, remove the patient immediately into the open air, and place him on his back with his head somewhat elevated, and pursue a treatment similar to that named in poisoning by the inhalation of sweet spirit of niter.

ACIDUM CHROMICUM (U. S. P.)—CHROMIC ACID.

FORMULA: CrO_3. MOLECULAR WEIGHT: 99.88.

SYNONYMS: *Chromic anhydride, Chromium trioxide.*

CAUTION: "Chromic acid should be kept in glass-stoppered bottles, and great caution should be observed to avoid bringing it in contact with organic substances, such as cork, tannic acid, sugar, alcohol, etc., as dangerous accidents are liable to result"—(*U. S. P.*).

Preparation and History.—To 1 volume, or 100 measures, of a cold, saturated solution of bichromate of potassium add 1½ volumes, or 150 measures, of pure sulphuric acid, and allow the mixture to cool in a covered capsule or in a flask; the sulphuric acid unites with the potassium, setting free a deposit of beautiful deep-red needles of chromic acid. The liquid being drained off, these are laid on a porous brick to dry, covered with a glass bell-jar. According to Prof. J. U. Lloyd, these crystals contain considerable adhering sulphuric acid, which, however, can not easily be separated. As high as 30 per cent of potassium sulphate has been found in some commercial samples (Krauch). According to Krauch, Merck has put forth a chromic acid almost absolutely free from sulphuric acid. It must be preserved in very tightly-stoppered vials. Chromic acid was discovered in 1797 by Vauquelin (who also that year discovered chromium), and was first obtained by the sulphuric acid method by Fritzsche in 1839.

Description.—Chromic acid occurs in beautiful deep, purplish-red, acicular, or quadrangular prismatic crystals, has a metal-like luster, without odor, deliquescent in the presence of moisture, and consequently very soluble in water. Solutions of it vary from brown-red to orange-yellow, according to the degree of concentration. The acid is perfectly anhydrous. It is a powerful oxidizer, and *should never be prescribed with any organic material* (anything that will burn), *or with any inorganic deoxidizer.* "When brought in contact with alcohol, ether, glycerin, and other organic solvents, decomposition takes place, sometimes with dangerous violence"—(*U. S. P.*). It dissolves in ether, but with strong alcohol it becomes explosive, and the alcohol burns. With diluted alcohol it slowly converts the alcohol into aldehyde and acetic acid. It behaves similarly with hydrogen sulphide, sulphurous and arsenous acids, and should not be heated or triturated with glycerin or sweet spirit of niter, as a dangerous explosion may result. On account of the facility with which it gives up its oxygen to organic matter, it is a powerful decolorizing or bleaching agent. Dilute solutions give a red color to litmus paper, bleaching the latter on drying. "When chromic acid is heated, its color darkens, and finally becomes black, but is restored on cooling. At 192° to 193° C. (377.6° to 379.4° F.) it fuses to a reddish-brown liquid, which, on cooling, forms a dark-red, brittle mass (often enclosing cavities filled with crystals), furnishing a scarlet powder. Above 250° C. (482° F.) it begins to decompose into green chromic oxide and free oxygen, and, after protracted heating, leaves a residue of pure chromic oxide, which should yield nothing soluble to water. A solution of 1 Gm. of chromic acid in 100 Cc. of water previously acidulated with a few cubic centimeters of hydrochloric acid should not be rendered turbid on the addition of 1 Cc. of barium chloride T.S. (absence of sulphuric acid)"—(*U. S. P.*).

Action and Medical Uses.—Chromic acid is exceedingly destructive to all lower forms of life. Small animals, such as mice, are entirely dissolved by it at a somewhat elevated temperature, not excepting even the bones, teeth, and hair. It coagulates albumen even more readily than nitric or carbolic acids or corrosive sublimate. Locally applied to the skin it is an exceedingly active corrosive, producing a deep eschar, which falls off in about 2 days, leaving a granulating base, which heals readily. By its contamination with foreign matter, as sulphuric acid, it is rendered painful in action, but when pure acts almost painlessly. If it be swallowed the same destructive action is observed on the tissues over which it passes, and perforation of the stomach may result. Alkalies, especially sodium bicarbonate and borax, and demulcents should be administered and the stomach pump employed. Stimulate by rectal enemas if necessary.

Chromic acid is recommended as an escharotic in the treatment of *piles;* the acid is to be applied freely over the whole of the diseased surface, and when properly managed it will not spread beyond the prescribed limits. It occasions uneasiness for some hours, and sometimes acute burning pain—a slough passes away, and the tumor shrinks and becomes insensible. As soon as its erosive operation is finished, the acid passes into a state of inert pulverulent sesquioxide. It is less painful than other caustics, and may be used to destroy morbid growths. It may likewise be found advantageous in *cancer*, *malignant tumors*, *ulcers*, *cysts*, *poisoned wounds*, *bites* of dogs, *gangrenous* and *scrofulous ulcers*, *hospital gangrene*, *pharyngeal ulcers* of a scrofulous or syphilitic origin, and to retracted and *ulcerated gums* in mercurialized and scrofulous individuals. *Tumors of the larynx* may be skillfully removed with it, as well as *adenoid growths* of the nasopharynx. Diluted it forms a good stimulant to *old ulcerations*. *Syphilitic ulcerations* and growths upon the tongue are to be treated with the acid (10 grains in 1 ounce of water). It is a prompt hemostatic. *Urethral caruncle* may be removed by it, and *uterine leucorrhœa* has been stopped by its skillful intra-uterine application, care being taken that the acid is not used strong enough to induce a cervical stricture. One part of the acid to 4½ parts of water forms a solution for removing *syphilitic morbid growths*, as *warts*, *condylomata*, *genital vegetations*, *phagedenic ulcers*, *papillomata*, etc.; it may be applied by means of a small glass rod, in all cases being careful not to allow it to act upon the healthy tissues, nor to penetrate too deeply or extensively into the parts upon which its action is directed. It has also been recommended in obstinate *granular conjunctivitis*, but should be used with great care, that it may not prove destructive to the cornea especially. *Granulations* and *polypi of the middle ear* may be removed with chromic acid, though it is inferior to salicylic acid for this purpose. Cauterization with chromic acid has been resorted to after the removal of *cholesteatoma* from the tympanum. Its use as a remedy for *hyperhidrosis of the feet* is not to be commended on account of the disagreeable after-effects that have often attended its employment. An aqueous solution of chromic acid of a pale-yellow color is used to harden and preserve nerve and muscle tissue, so that they may be cut into thin sections for the microscope. Pus, mucus, blood corpuscles, and other delicate structures for microscopic investigation may be preserved in a solution of 1 part of chromic acid to 20 of water. For topical use the pure acid or its *aqueous* solution only should be employed. It should be remembered that with glycerin and some other solvents it violently explodes.

ACIDUM CHRYSOPHANICUM.—CHRYSOPHANIC ACID.

Formula: $C_{15}H_{10}O_4$. Molecular Weight: 253.39.

Source and History.—Chrysophanic acid was discovered by Schrader, in 1819, in the *Parmelia parietina*, Linné, a common wall lichen. He obtained it impure, and named it "resinous yellow of wall lichens." It was found in this lichen in 1843, and purified by Rochleder and Heldt, who gave it the name *chrysophanic acid*, from its yellow color (*Ann. der Chem. und Pharm.* xlviii). Shortly after this, Schlossberger and Dopping decided the coloring matter obtained from rhubarb to be identical. This coloring matter had been known under the names of rheine, rheumine, rhabarberic acid, rhubarb yellow, etc., names doubtless given to impure forms of chrysophanic acid, *emodin*, especially, being intimately associated with it. Each of these substances are dissolved by benzin, the chrysophanic acid more freely. According to E. Bourgoin, chrysophanic acid is present, in small amount, in senna leaves, and may be obtained by extracting crude cathartin, with ether. It is likewise found in yellow-dock root, in small amount, and a prolific source of it is *araroba* (Attfield).

Preparation.—Chrysophanic acid may be prepared from araroba, as follows: Mix in a flask 1 part of araroba, in powder, with 8 parts of benzin, and bring to a boil; filter while hot, and when the liquid ceases to pass, return the undissolved matter to the flask, and add 8 parts of benzin; boil, and filter, as before. Mix the filtrates, and evaporate to dryness. Dissolve the yellowish powder in 16 parts of boiling alcohol, filter, and add to the filtrate 32 parts of cold distilled water. Allow this to stand for 24 hours, then separate the yellow precipitate, by means of a muslin strainer, or filtering paper, and dry by exposure to the atmosphere.

From Rhubarb, chrysophanic acid may be obtained by exhausting the coarsely-ground root with water, evaporating the solution to dryness, extracting the residuum with boiling benzin, then evaporating the benzin, and, finally, purifying the residue by solution in hot alcohol, and precipitation with water, the same as stated above, in procuring it from araroba. Thus obtained, it contains *emodin*, but is pure enough for all practical purposes. The yield from rhubarb is small.

Description.—When pure, chrysophanic acid is in golden-yellow needles, but considerable of that at present upon the market is in the form of a brownish-yellow powder. Subsequent investigations showed it to be dioxymethyl anthraquinone ($C_{15}H_{10}O_4$), while emodin was ascertained to be trioxymethyl anthraquinone ($C_{15}H_{10}O_5$).

Chrysophanic acid is volatile at high temperatures, is soluble to a slight extent in cold, and a little more freely in hot water. It dissolves readily in alcohol, ether, benzin, and glacial acetic acid, to which it imparts a yellow color. Cold sulphuric acid dissolves it without decomposition, and with the formation of a red color, from which solution water precipitates it in yellow flakes. It dissolves in alkaline solutions, with the production of a beautiful red color, from which solution excess of acids precipitates it, and the liquid becomes decolorized. It has but little taste and no odor. Its fusing point is at 162° C. (between 323° and 324° F.).

Action, Medical Uses, and Dosage.—Chrysophanic acid has been chiefly employed as a local application in certain cutaneous affections, as *mentagra, eczema, herpes tonsurans, herpes circinati, psoriasis, acne rosacea*, etc. It is generally applied in the form of an ointment, consisting of from 10 to 120 grains of the acid to 1 ounce of hot lard (360° F.), with which the acid must be thoroughly incorporated. The parts affected having been carefully washed, to remove fatty substances, and any existing scales (*squamæ*) having been softened and carefully removed, this ointment is to be well rubbed in upon the parts, 2 or 3 times a day. The strength of the ointment, and the number of applications per day, will depend considerably upon the amount of irritation occasioned, as it frequently gives rise to more or less irritation, or even inflammation of the skin. When applied about the face and head, care should be taken to protect the eyes from its irritant action. Its use is often objected to by patients, on account not only of its staining the clothing and bed-clothes a dull purple color, but likewise of its giving a more or less dark purplish tint to the skin, and a yellow color to the hair, with which it comes in contact. Mr. Balmano Squire, of London, Eng., to whom we are indebted for a knowledge of this agent, states that a careful use of bleaching powder will remove the stains from clothing; and liquor potassæ, considerably diluted with water, will, it has been stated, discharge the discoloration of the skin and hair. While rubbing it upon the parts, the fingers may be protected from discoloration by wearing india-rubber finger tips, or by rubbing the stained parts with benzol.

Internally, but little is satisfactorily known as to the effects of chrysophanic acid. In small doses, from 4 to 8 grains, it has occasioned vomiting and in doses of from 10 to 20 grains both vomiting and purging. The time of action varies from 4 to 24 hours after it has been taken, and persists, in many cases, for 2 or 3 days. Liquor potassæ, taken subsequently to the dose of the acid, appears to increase its activity. Napier states that *psoriasis* yielded to half-grain pills of chrysophanic acid administered 3 times a day, after meals, continuing the drug until its physiologial effect, gastro-intestinal irritation, was felt. Arsenic and various local applications had been used without producing any good results. In one case as much as 9 grains in 24 hours were taken without deleterious effects.

ACIDUM CITRICUM (U. S. P.)—CITRIC ACID.

FORMULA: $H_3C_6H_5O_7+H_2O=C_3H_4(OH)COOH)_3.H_2O$. MOLECLUAR WEIGHT: 209.50.

SYNONYMS: *Acidum citri, Acidum limonum, Acidum limonorum, Acidum limonis.*

"An organic acid, usually prepared from lemon juice"—(*U. S. P.*).

Source and History.—Citric acid of commerce is prepared from the juices of the lemon, the lime, and the bergamot. It was first obtained, in 1776, by Retzius, who distinguished it from acetic and tartaric acids. In 1784, Scheele first obtained it in crystalline form. In 1880, it was prepared from glycerin, and also from malic acid. Besides being derived from the sources named, it exists in a free or combined state as citrate of calcium or potassium in many fruit-juices, as of whortleberries, cranberries, gooseberries, strawberries, blackberries, raspberries, red elderberries, currants, cherries, tomatoes, tamarinds, cayenne, and in the fruits of bittersweet and of a solanaceous plant of South America and Mexico, known as the "*tomato de la paz*" (*Cyphomandra botacea*). It is also present in Jerusalem artichoke, dahlia tubers, and in the rhizomes of red puccoon, and Asarum europæum. Both the tobacco plant and lettuce contain it. While abundant in the red elderberry the present supply is almost entirely derived from fruits of the orange family. England produces the acid on a large scale from Italian lemons and limes. It is also made from the sour oranges of Florida.

Preparation.—The juice, if fresh and from sound fruit, is first clarified by boiling, then strained and saturated to excess with calcium carbonate or milk of lime. If the juice be derived from decayed fruit, vinous fermentation is allowed to proceed instead of boiling it. The calcium citrate is then precipitated in hot water (being less soluble in hot than in cold water) and the supernatant liquid drawn off. The calcium salt is then washed with hot water to purify it. A slight excess of diluted sulphuric acid is now added to decompose the calcium citrate. By this process calcium sulphate is thrown out after which the citric acid solution is drawn off. The calcium sulphate is then agitated with either very cold or hot water, and the washings, together with the citric acid solution, are then heated by steam until of the consistence of syrup when it is crystallized in leaden vats. Crystallization is facilitated by the presence of sulphuric acid; by redissolving the acid in a little water and purifying with animal charcoal, the commercial crystals will be deposited from the filtered solution.

Description and Tests.—Citric acid is that acid whose sourness is typical of that of the lemon. It occurs in "colorless, translucent, right-rhombic prisms, odorless, having an agreeable, purely acid taste; efflorescent in warm air, and deliquescent when exposed to moist air. Soluble at 15° C. (59° F.), in 0.63 part of water, and in 1.61 parts of alcohol; in about 0.4 part of boiling water, and in 1.43 parts of boiling alcohol; also soluble in 18 parts of ether. When heated to about 75° C. (167° F.) the acid begins to lose its water of crystallization; at about 135°C. (275° F.) it becomes anhydrous, and melts between 135° and 152° C. (275° and 305.6° F.). When slowly ignited it is gradually decomposed without emitting the odor of burning sugar (difference from tartaric acid), and is finally consumed without leaving more than 0.05 per cent of residue"—(*U. S. P.*). It reddens litmus and forms the line of salts known as citrates, of which the alkaline salts are freely soluble in water. Calcium citrate is soluble in cold, but not in hot water. The dehydrated acid when heated to 155° C. (311° F.) yields water and *aconitic acid* identical with that obtained from aconite, achillea, hellebore, and other plants.

The aqueous solution of citric acid spoils by keeping, forming acetic acid as one of its products. A solution of about the strength of lemon juice may be prepared by adding to one ounce of water about two-thirds of a drachm of citric acid. A portion of this added to water until sufficiently sour and then sweetened to taste, affords a fairly good substitute for lemonade. The addition of a small portion of lemon essence improves the taste. A solution of 1 part of the acid to 2 parts of distilled water will keep sufficiently long to be utilized at the "soda counter." Heated with caustic potash or with nitric acid, citric acid is converted into oxalic acid.

"On adding 1 Cc. of an aqueous solution (1 in 10) of the acid to 50 Cc. of calcium hydrate T.S. (or so much more of the latter that the mixture has an alkaline reaction), the liquid remains clear. Upon boiling this for about one minute, it becomes opaque through the precipitation of calcium citrate, which redissolves on cooling. If 1 Gm. of the powdered acid be dissolved in 5 Cc. of a cold solution (1 in 3) of potassium acetate, the liquid should remain clear, even after the addition of an equal volume of alcohol (absence of tartaric or oxalic acid). On mixing 10 Cc. of a 10 per cent aqueous solution of the acid with a quantity of ammonia water insufficient to neutralize it completely, and adding to one-half of this liquid 1 Cc. of ammonium oxalate T.S., it should remain clear (absence of calcium). The other half, mixed with a few Cc. of hydrogen sulphide T.S., should not deposit a colored precipitate, nor acquire more than a faintly brownish-yellow tint (limit of metallic impurities). On treating 10 Cc. of a 1 per cent aqueous solution of the acid with 1 Cc. of barium chloride T.S. and a few drops of hydrochloric acid, the liquid should not show any turbidity within five minutes (limit of sulphuric acid). To neutralize 3.5 Gm. of citric acid should require 50 Cc. of potassium hydrate V.S. (each Cc. corresponding to 2 per cent of the pure acid), phenolphtalein being used as indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Though fatal to rabbits, cats, and other animals, producing heart failure, violent tetanic convulsions, and finally death, it has not produced the death of man. Its continued use acts destructively on the teeth. Large doses are irritant to the gastro-intestinal tract, and may act as a poison in this way. It is principally carried off by the kidneys, rendering the urine acid if the amount taken be large. The coagulability of the blood is retarded by it. This acid is used as a refrigerant and antiscorbutic, rendering the blood more fluid by lessening its coagulability. In all *febrile diseases*, a sweetened solution of it will be found a very beneficial drink, especially in those cases where the tongue is coated brown, dark or red; it may be flavored with a few drops of the essence of lemon. It is likewise beneficial in *scurvy* (though far less effective than fresh lemon juice), *acidity of the stomach* and some peculiar forms of *sick headache*. It has also been advised in *gout* and *inflammatory rheumatism*, but its liability to occasion gastric acidity, and increase of uric acid in the urine, are serious objections to its employment in these diseases, aside from the failures that have followed its use on many occasions. Prof. Scudder recommends lemonade or lemon juice in those cases only where the tongue is red and long, and the inflamed parts show excessive redness. A lemonade powder, which will keep for years if preserved dry, is made by mixing together 4 ounces of powdered white sugar with 3 drachms of powdered citric acid and 2 drops of oil of lemon. Half a teaspoonful of this mixture may be dissolved in a tumbler of water for a beverage. The continued use of citric acid disturbs the functions of the digestive organs. M. Girard, Chief of the Paris Municipal Laboratory, claims that citric acid is an efficient purifier of polluted water, 1 grain of the acid being destructive to the micro-organisms in a quart of water. For this reason he advises the use of lemonade during *epidemics*. Locally, it is useful in *hypertrophied tonsils*, *elongated uvula*, and *genital pruritis*. The dose of citric acid is from 5 to 30 grains; lemonade at will.

Specific Indications.—Inflammatory rheumatism, showing excessive redness of inflamed parts and elongated, reddened tongue; scorbutus; febrile states, with red, elongated tongue. Lemon juice as an antirheumatic when the tongue is markedly red, papillæ prominent, and usually thinly-coated white.

Related Product.—ACIDUM CITRICUM SACCHARATUM (N. F.), *Saccharated citric acid. Formulary number*, 5: "Citric acid (*U. S. P.*), in very fine powder, six hundred and twenty-five grammes (625 Gm.) [1 lb. av., 6 ozs., 20 grs.]; sugar, in very fine powder, three hundred and seventy-five grammes (375 Gm.) [13 ozs. av., 100 grs.]. Triturate the powders together until intimately mixed, and preserve the product in well-stoppered bottles. *Note.*—This saccharate, when dissolved in water with an equal weight of saccharated sodium carbonate (F. 341), will form a neutral solution, and it is introduced into this formulary for the convenient preparation of effervescent powders (F. 319). This saccharate contains 62.5 per cent of crystallized citric acid"—(*Nat. Form.*).

ACIDUM FORMICUM.—FORMIC ACID.

FORMULA: $H_2CO_2=HCHO_2$. MOLECULAR WEIGHT: 45.89.

Source and History.—This acid was first obtained by the distillation of ants, by Samuel Fisher (Lavoisier). A. S. Marggraff examined it in 1749, and Ardwissan and Oehrn, of Leipsic, in 1777, fairly establishing its identity as a definite compound. However, in 1802, Fourcroy and Vauquelin endeavored to prove that it was a mixture of acetic and malic acids; but their opinions were refuted by Suersen and Gehlen. Berzelius (1817) first attempted to determine its composition (*Annals of Philosophy*, Vol. IX, p. 107), by burning formate of lead and chlorate of potassium in a glass tube, thus deciding that it contained oxygen, hydrogen, and carbon. Formic acid is found in certain caterpillars, and, doubtless, the "*bombic acid*" Lavoisier mentions as being obtained from silk-worm larvæ that are changing to chrysalides, was impure formic acid.

The "*spirit of magnanimity*," of Hoffman, was made by extracting red ants with spirits of wine. Later, Mr. F. Will has shown that the fluid in the hairs of a species of caterpillar, which causes inflammation of the skin when handled, and the poisoning by the stings of some insects, is due to the formic acid present. It has also been demonstrated that the stinging hairs of the nettle, *Urtica urens* and *Urtica dioica*, contain this acid. Formic acid is also found in pine-tree leaves, and in the blood, bile, urine, perspiration, and muscular tissues of man.

Preparation.—Formic acid derived its name from the fact that it was obtained by distillation of red ants (*Formica rufa*, Linné). Doebereiner discovered, in the early part of the present century, that it could be prepared artificially by the distillation of tartaric acid, water, sulphuric acid, and black oxide of manganese. At present, it is known that many organic bodies yield this acid, when distilled with black oxide of manganese and sulphuric acid, or with chlorinated lime, or with bichromate of potassium; but decidedly the best process is that based upon the principle discovered by Berthelot (*Comptes Rendus*, March 1856), that oxalic acid and glycerin will produce it, when heated together. 4 parts each of oxalic acid and glycerin are to be mixed with 1 part of water, and a heat of 100° C. (212° F.) applied 12 or 15 hours, or until the acid is decomposed. The residuum is now to be mixed in a still with its bulk of water, and distilled. It is then again mixed with the same quantity of water, and distilled, the operation being repeated, if the formic acid remains in amount to justify. In this process monoformate of glycerin is formed as an intermediary product, which, upon distillation with water, splits into glycerin and formic acid, as follows:

$$C_3H_5(OH)_3+C_2O_4H_2=C_3H_5(OH)_2O(CHO)+CO_2+H_2O.$$
$$C_3H_5(OH)_2O(CHO)+H_2O=C_3H_5(OH)_3+H.COOH.$$

The distillates are to be mixed, neutralized with carbonate of lead, then evaporated to dryness, and distilled with sulphuric acid if desired pure; generally, however, the diluted acid is preferable. Another process was suggested by the Professors Rogers, in 1847, in which sugar was added to a solution of bichromate of potassium, and distilled, while sulphuric acid was slowly added. This requires great care, however, as, according to our experience, if the acid is allowed to enter too rapidly, the reaction becomes very violent, and may occasion disastrous effects. Besides, if distillation is conducted beyond a certain point, sulphurous acid contaminates the distillate.

Description.—Formic acid is represented by the formula $HCHO_2$, thus a molecule contains the elements of water, H_2O, and carbonic oxide, CO. It is a colorless, strongly acid liquid, when concentrated capable of removing the cuticle. It does not char when heated, even with sulphuric acid, but in the latter case splits up into water and carbonic oxide. It dissolves freely in water, glycerin and alcohol, and forms salts soluble in water. When ignited, the vapor burns with a blue flame. Its odor is pungently acid, and its taste a sharp, biting sour. The salts of gold, platinum, mercury and silver are reduced when heated with formic acid, and the metals deposited. Anhydrous formic acid crystallizes below 0° C. (32° F.), and, according to Attfield, boils at 105° C. (221° F.). The experiments of Jardin show that the molecule of formic acid is incapable of furnishing carbon assimilable to even the simplest cellular organisms, and solutions of formiates remain perfectly clear many months.

Action, Medical Uses, and Dosage.—Formic acid applied to the skin acts as an irritant, and produces a violent, burning pain, and may vesicate. If kept in contact with the tissues, it will even cause ulceration. Gastro-intestinal inflammation and bloody urine were the results of its administration to rabbits. In man it acts as an excitant to the circulation, and increases the renal secretions, sometimes causing the passage of clouded, offensive urine. Moderate doses induce hurried respiration and rise of temperature, while larger doses cause rapid breathing, and lower the temperature. If administered at all, it should be largely diluted.

Formic acid is rarely employed in medicine; it was, at one time, used externally as a local irritant, *in sluggish capillary circulation*, in certain *painful affections*, and in *enfeebled* or *paralytic conditions of the limbs*. The *German Pharmacopœia* has a "spirit of ants" [*Spiritus Formicarum*=Formic acid (2), water (26), alcohol (70)], used in *chronic rheumatism*, etc., in doses of from 10 drops to a fluid drachm; also as an external rubefacient. It may also be made by macerating, for 2 days, 1 part of fresh red ants in 1½ parts, each, of alcohol and water, and then distilling off 2 parts. It forms a clear, acid fluid, yielding feathery crystals when mixed with $\frac{1}{20}$ part of subacetate of lead solution. Combined with ammonium (*formiate of ammonium*), the salt formed has been tried in *chronic paralytic affections*, and even in *epilepsy*, but without success; the dose is 4, 5, or 6 grains.

ACIDUM GALLICUM (U. S. P.)—GALLIC ACID.

FORMULA: $HC_7H_5O_5+H_2O$. MOLECULAR WEIGHT: 187.55.

SYNONYMS: *Trioxybenzoic acid*, *Dioxysalicylic acid*.

"An organic acid, usually prepared from tannic acid"—(*U. S. P.*).

Source, History, and Formation.—Though existing in a number of astringent plants, the greater portion of commercial gallic acid is derived from nutgalls. Scheele (1785), who first obtained it pure, established its non-identity with tannic acid. The manner of formation of gallic acid from nutgalls has been a subject of much discussion and experimentation. Before investigations were begun it was believed to exist ready-formed in galls, but in 1833 Pelouze showed that the larger portion of it was derived from the tannin of the galls, and advanced the theory that this conversion was accomplished by oxidization by the atmospheric oxygen, by which carbon dioxide was driven off. The elder Robiquet (1837) showed that its conversion could be accomplished without the aid of oxygen and without evolving carbon dioxide, but that it resulted from a ferment called *pectase*. Wetherill (1847), and subsequently Mulder (1848), attempted to show that tannic acid differed from gallic acid only in the possession of a larger amount of water of crystallization. Liebig believed the change to be due to the liberation of a carbohydrate. In 1854 Strecker came to the conclusion that tannin was a glucosid, for by boiling it with diluted mineral acid he obtained a large amount of gallic acid and considerable glucose. This view was generally accepted for a long time, though opposed by the younger Robiquet (1854) and Hlasiwetz (1867), who advanced different theories regarding the supposed glucosid. The present theory is that advanced by Schiff (1871) and supported by others, that pure tannic acid be viewed as *digallic acid* (this being the first anhydrid of gallic acid), and that natural *tannin* is the glucosid of *pure tannic*, or *digallic acid*, for by the action of hot diluted mineral acids or a nitrogenous ferment upon it, digallic acid and glucose are evolved.

Preparation.—Considerable gallic acid is now made by the sulphuric acid process. The *British Pharmacopœia* directs that 1 part of coarsely powdered galls be boiled for one-half hour with 4 parts (fluid measure) of diluted sulphuric acid and strained through cloth while hot. Crystals are deposited when cool, and are to be collected, treated with animal charcoal, and repeatedly crystallized.

The method more generally employed is as follows: Take of finely-powdered nutgalls, 3 Troy pounds. Mix the galls with enough distilled water to form a thin paste and expose the mixture to the atmosphere by allowing the vessel to stand in a warm place for about 4 weeks, taking the precaution to see that it has at all times sufficient distilled water to maintain a thin, pasty consistence, and to stir the mass occasionally with a glass rod. A porcelain or glass vessel should be used for this operation, and in no instance should an iron dish be employed, as iron or the presence of iron salts give to the product a color very difficult of removal. After exposure of the mixture for the required length of time the pasty mass is to be expressed and the residue is added to 8 pints of distilled water and boiled for a short time, and filtered through pure animal charcoal while hot. Upon cooling crystals of gallic acid are deposited, which, if further purification is necessary may be again dissolved, treated with charcoal, and recrystallized.

Description.—Gallic acid forms delicate "white, or pale fawn-colored, silky, interlaced needles, or triclinic prisms, odorless, having an astringent or slightly acidulous taste; permanent in the air. Soluble at 15° C. (59° F.), in 100 parts of water, and in 5 parts of alcohol; in 3 parts of boiling water, and in 1 part of boiling alcohol. Also soluble in 40 parts of ether, and in 12 parts of glycerin. Very slightly soluble in chloroform, benzol, or benzin. When heated at 100° C. (212° F.), the acid loses its water of crystallization (nearly 9.6 per cent). At about 222° C. (431.6° F.), it begins to melt, and at a higher temperature it is gradually decomposed. At a low, red heat it is consumed without leaving a residue. Gallic acid has an acid reaction"—(*U. S. P.*).

Gallic acid is entirely sublimed when heated, yielding carbonic acid gas and *pyrogallol* ($C_6H_6O_3$).

Tests.—"If 5 Cc. of a cold, saturated, aqueous solution of the acid be treated in a watch-glass, with 6 drops of sodium hydrate T.S., the liquid will gradually acquire a deep-green color, which is changed to reddish or brownish-red by acids. Gallic acid neither colors nor precipitates pure ferrous salts, but forms a bluish-black precipitate with ferric salts. On adding to a cold, saturated, aqueous solution of gallic acid some calcium hydrate T.S., a bluish-white precipitate will form, where the test solution is temporarily in excess, and will disappear on shaking. When the test solution has been added in excess, the precipitate no longer dissolves, and the liquid acquires a tint which is blue by reflected and green by transmitted light, and becomes pink on the addition of a large excess of calcium hydrate T.S. (distinction from tannic acid). An aqueous solution of the acid should not precipitate alkaloids, gelatin, albumen, or starch T.S. (difference from and absence of tannic acid)"—(*U. S. P.*).

Solutions of gold, platinum, and silver salts, as well as those of the allied metals, are reduced by gallic acid or its salts, the solution of argentic nitrate converting gallic into tannic acid.

Action, Medical Uses, and Dosage.—Gallic acid does not coagulate albumen, and when ingested is quickly absorbed, and rapidly discharged by the kidneys, over the secretions of which, as well as of the skin, it has a marked control. Gallic acid is much inferior to tannic acid as a topical astringent, but administered internally, it is more powerful as a remote astringent. Indeed, tannic acid, in its passage through the system, becomes changed into gallic acid. As a remote astringent, gallic acid has been found very beneficial in *uterine*, *pulmonary*, and *nephritic hemorrhages*, and all *hemorrhages* of a passive character. *Menorrhagia* has promptly ceased under its use. Give 5 grains, in pill form, 3 or 4 times a day during the flow, as well as during the intermenstrual period. It is best adapted to chronic passive cases. It has also been found useful in *night sweats*, *pyrosis*, *chronic mucous discharges* from the bowels and bladder, and has some reputation in arresting the excretion of albumen in *Bright's disease* of the kidney, and assists in maintaining the patient's strength. In *hemoptysis* give 3 grains each of gallic acid and Dover's powder every 2 hours, and at the same time administer ergot by the mouth or hypodermatically (Locke). From 2 to 5 grains every 3 hours controls bleeding from the nose and bowels during *typhoid fever*. As a remedy in *diabetes insipidus* it is asserted to arrest the polyuria by promptly constringing the relaxed renal capillaries. From 10 to 30 minims of the glycerole should be administered 4 times a day (Webster). Some cases of old, *purulent conjunctivitis* are cured by it, and it is of value in *trachoma* with soft, pasty granulations. One part of gallic to 3 parts of tannic acid should be insufflated upon the parts twice daily (Foltz). It has given benefit in *purpura*. Costiveness is not produced by its use. Its dose is from 3 to 20 grains 3 times a day, or oftener; it may be used in the same form as the tannic acid; of the glycerole, 5 to 60 minims. Its hydro-glycerin solution may be employed as a wash, gargle, or injection.

Specific Indications and Uses.—Passive hemorrhages, with pulse feeble and extremities cold, skin inelastic, and capillaries relaxed; hematuria, with nausea, vertigo, headache, and dull aching in the region of the kidney; soft, pasty, granular conjunctivitis.

ACIDUM HYDRIODICUM.—HYDRIODIC ACID.

FORMULA: HI. MOLECULAR WEIGHT: 127.53.

SYNONYM: *Hydrogen iodide*, *Iodide of hydrogen*, *Acidum iodhydricum.*

Source and History.—This substance was discovered shortly after the detection of iodine. The process for its preparation, recommended in Dana's *Chemical Philosophy* (1825), by mixing moistened iodine with phosphorus, is almost identical with that offered in some of the more recent works. A solution of the gas was official in the *U. S. P.* (1860), being made from iodine, by decomposing hydrogen sulphide with iodine in the presence of water, thus: $2H_2S+I_4 = 4HI+S_2$. This formula, according to Naumann (Roscoe's *Treatise on Chemistry*, Vol. I, p. 160), can not yield an acid of greater specific gravity than 1.56.

Preparation.—It may be prepared in practice by mixing 30 grains of powdered iodine with 5 fluid ounces of distilled water, and then passing hydrogen sulphide through the mixture, until the iodine has disappeared; saturate this liquid with iodine, and again decolorize, with hydrogen sulphide. Repeat the operation until 480 grains of iodine have been used. The liquid now contains much precipitated sulphur and some free hydrogen sulphide. Boil it gently, to drive off the latter impurity, then filter, and bring the filtrate to the measure of 6 fluid ounces, by washing the filter with distilled water. If an attempt is made to pass the hydrogen sulphide through water mixed with all of the iodine, the first action will be attended by a deposition of sulphur over the particles of iodine, thus protecting the enveloped particles from the action of the gas. This objection is overcome by taking advantage of the fact that iodine is soluble in a solution of hydriodic acid, and thus we successively dissolve the iodine, and then pass hydrogen sulphide through each solution.

Description.—Hydriodic acid is a colorless, non-inflammable gas, possessing strong acid properties, and a suffocating odor. It fumes when exposed to the atmosphere, and has the sp. gr. (air=1) of 4.3737. Gay-Lussac demonstrated it to be composed of equal volumes of vapor of iodine and of hydrogen, by allowing it to remain in contact with mercury, whereby all of the iodine was absorbed, and the original volume reduced one-half. It is decomposed by heat, the iodine exhibiting itself as a violet vapor. Oxygen, chlorine, and bromine decompose it, liberating iodine. Sunlight slowly decomposes the gas, but does not affect its solutions if they be kept free from air. Faraday discovered that at 0° C. (32° F.), under the pressure of 4 atmospheres, it condenses into a colorless liquid. At —55° C. (—67° F.) it freezes to a clear, colorless, transparent mass, resembling ice. It forms salts with the vegetable alkaloids.

Solution of hydriodic acid is the hydriodic acid of commerce. It somewhat resembles hydrochloric acid, but is less stable. It can not be kept for any length of time, as, by exposure to the air, oxygen unites with the hydrogen, forming water, and the iodine is liberated, which, dissolving in the solution, imparts to it a brownish-red color. This change may be corrected to some extent by the addition of a small quantity of sodium hyposulphite, about ½ grain to the ounce of acid (Dunn, 1868). As soon as made, it should be securely sealed in small, glass-stoppered bottles, filled to the stopper, and placed in a cool situation until used. It has a pungently sour, styptic taste.

Action, Medical Uses, and Dosage.—Dr. Andrew Buchanan, of Glascow, Scotland, introduced this acid as a medicine. He believed it to possess all the therapeutic virtues of iodine, without its irritant qualities. His views have, in a large measure, been substantiated by other physicians, and it is now given whenever the introduction of iodine into the system is required. Used in the form of a syrup containing 1 per cent of absolute acid, it is found to be very efficient in all forms of *scrofulous diseases*, and is much employed by members of the regular school of medicine in *chronic catarrhal pneumonia*, and other *chronic pulmonary complaints*. It has served a good purpose in the spasmodic form of *asthma* in gouty subjects. *Pulmonary indurations*, following pneumonia, are reduced by it, and absorption of *pleuritic deposits* favored by the administration of the syrup. In this way a peculiarly effective action is obtained from the nascent iodine, which is liberated in the system. In many cases its use should be preferred to that of the element itself. Should free iodine be liberated in the syrup, which may be known by its coloring the preparation yellowish or red, it may be overcome by the addition of a small amount of sodium hyposulphite, and if this be not at hand, the medicament may be administered in rice-water, or starch-water. By the latter method, by the action of these amylaceous substances, the free iodine will be converted into an inert iodized starch. Syrup of hydriodic acid is recommended in *periodic hyperæsthetic rhinitis*, or *hay asthma*, and undoubtedly has some beneficial effect in this unpleasant malady. The acid may also be used by dropping 1 or 2 drops on a lump of sugar and administering every 2 or 3 hours (Prof. Howe, in *Ec. Med. Jour.*, 1884). It has been used successfully in *acute rheumatism*, in *scrofulous skin diseases*. and in various forms of *poisoning by lead*, and in chronic arsenical poisoning. It has benefited cases of *locomotor ataxia*. It is a valuable remedy in some forms of *muscular rheumatism*, and in the latter stages of *constitutional syphilis* when the stomach will not tolerate the iodides or other antisyphilitics. Foltz finds it useful in *specific phlyctenular disorders*, *interstitial keratitis*, in *syphilitic iritis*, and *purulent otitis media* of specific origin (*Dynam. Therapeutics*). It has been used successfully in *obesity*. Its further action is that of iodine, to which the reader is referred. The syrup of hydriodic acid having the best reputation among practitioners for stability and efficiency, is that made by R. W. Gardner, of New York City. The dose of the syrup ranges from 30 drops to ʒiv.

ACIDUM HYDROBROMICUM DILUTUM (U. S. P.)—DILUTED HYDROBROMIC ACID.

FORMULA: HBr. MOLECULAR WEIGHT: 80.76.

SYNONYMS: *Hydrogen bromide*, *Bromide of hydrogen*.

"A liquid composed of 10 per cent, by weight, of absolute hydrobromic acid [HBr=80.76] and 90 per cent of water. Diluted hydrobromic acid should be kept in glass-stoppered bottles, protected from light"—(*U. S. P.*).

Source and History.—This acid closely resembles hydriodic acid, and may be prepared in similar ways. Hydrogen and bromine do not unite at ordinary temperature, but the vapor of bromine will unite with hydrogen in a red-hot tube, containing finely-divided platinum; equal volumes combining to form hydrobromic acid (*hydrogen bromide*). It was obtained by Balard shortly after he discovered bromine (1826), but attracted little attention, excepting from experimental chemists, until within a few years past. It was generally prepared by gently warming a mixture of bromine, phosphorus, and water, or bromine, phosphorus, water, and bromide of potassium; but either process is attended with danger. A very old process is by the reaction of sulphuric acid upon bromide of potassium, whereby hydrobromic acid and sulphate of potassium are produced; the process is defective, however, as formerly applied, from the fact that the distillate contained sulphurous acid and free sulphuric acid; but investigations of Dr. Squibb have shown that this difficulty may be overcome, and, upon the authority of that careful experimenter, we present the following mode, as condensed from his process (*Amer. Jour. Pharm.*, March, 1878).

Preparation.—Mix 7 parts of sulphuric acid with 1 part of water. and allow the mixture to cool. Dissolve 6 parts of bromide of potassium in 6 parts of distilled water by means of heat, and pour into it the diluted sulphuric acid. We advise mixtures of sulphuric acid and water to be made by placing the water in an evaporating basin, and pouring the sulphuric acid, in a small stream, upon the side of the vessel, just above the surface of the water, stirring the mixture gently. Place the mixture aside, in a cool situation, for 24 hours, then decant the liquid into a vessel, and transfer the crystalline mass to a funnel stopped with cotton; pour slowly upon it 2 parts of cold water, and allow it to drain into the reserved solution in the vessel; transfer this liquid to a retort connected with a Liebig condenser, and carefully distill 10 parts, or nearly to dryness; then add to the distillate 2 parts of distilled water. All the foregoing proportions are by weight, and the product will represent about 34 per cent of hydrobromic acid.

The following table, by Dr. C. R. A. Wright (*Chem. News*, May 26th, 1871) will be of use in determining the percentage of hydrobromic acid in solutions of different specific gravity:

Percentage	of hydrobromic	acid,	5	Specific	gravity,	at 15° C.	(59° F.),	1.038
"	"	"	10	"	"	"	"	1.077
"	"	"	15	"	"	"	"	1.117
"	"	"	20	"	"	"	"	1.159
"	"	"	25	"	"	"	"	1.204
"	"	"	30	"	"	"	"	1.252
"	"	"	35	"	"	"	"	1.305
"	"	"	40	"	"	"	"	1.365
"	"	"	45	"	"	"	"	1.435
"	"	"	50	"	"	"	"	1.515

According to A. Bertrand (*Compt. Rend.*, lxxxii, p. 96), phosphoric acid may be substituted for sulphuric, when distilling with an alkaline bromide, thus overcoming the liability of the product to contain sulphurous acid. The composition of hydrobromic acid is represented by the formula HBr; the reaction which takes place when made from phosphorus, bromine, and water, being represented by the formula $P+3Br+3H_2O=3HBr+H_3PO_3$; that when made from sulphuric acid and bromide of potassium, by the formula, $2KBr+H_2SO_4=2HBr+K_2SO_4$.

Description and Tests.—Hydrobromic acid is a colorless gas, fuming in the air, and irritating to the lungs when inhaled. It condenses to a colorless liquid, at a temperature of —71.6° C. (—99° F.), and solidifies, to an ice-like mass, at —87.2° C. (—125° F.) (Faraday, *Phil. Trans.*, 1845). Its diffusive power is that of hydrochloric and hydriodic acids (Graham). Aqueous hydrobromic acid is colorless, and imparts an acid taste. If very weak it becomes stronger, or if very strong weaker, by distillation, until the acid within the retort contains from 47 to 48 per cent of hydrobromic acid. Hydrobromic acid evaporates completely, no residuum remaining; should sulphuric acid be present, a white precipitate will be formed, upon the addition of solution of chloride of barium. Should hydriodic acid be present its detection is rendered easy by exposing a quantity of the acid to the air. If it turns reddish or yellow, and gives a blue precipitate with starch-paste, iodine is present as a contamination. It is *incompatible* with alkalies and alkaline carbonates, with which it forms "bromides;" likewise, with plumbic, argentic, and mercurous salts, in solution, with which it forms precipitates of the corresponding bromides.

ACIDUM HYDROBROMICUM DILUTUM (*U. S. P.*). *Diluted hydrobromic acid.*—The official acid contains 10 per cent of absolute acid, and is described in the Pharmacopœia as—"A clear, colorless liquid, odorless, and having a strongly acid taste. Specific gravity about 1.077 at 15° C. (59° F.). Miscible, in all proportions, with water and alcohol. By heat it is completely volatilized. On distilling it water and weak acid first pass over. When the temperature of 126° C. (258.8° F.) is reached, an acid of 47.8 per cent remains, which may be distilled unchanged. With litmus paper it shows a strongly acid reaction. On adding an equal volume of chlorine water to diluted hydrobromic acid, bromine is liberated, and if a few drops of chloroform are now added and shaken with it, the bromine will dissolve in the chloroform with a yellow color (absence of iodine). Silver nitrate T.S. causes a yellowish-white precipitate, somewhat soluble in hydrobromic acid, insoluble in diluted nitric acid, very slightly soluble in ammonia water, but more soluble in stronger ammonia water. Copper sulphate T.S produces a deep-red color upon addition of sulphuric acid. On being kept for some time the acid should not become colored. Barium chloride T.S. should not produce a turbidity or precipitate (absence of sulphuric acid). If 1 Cc. of the acid be mixed with 1 Cc. of stannous chloride T.S. (see *List of Reagents*, Bettendorff's Test for Arsenic), and a small piece of pure tin-foil added, no brown coloration should appear within half an hour (limit of arsenic). To neutralize 8.08 Gm. of diluted hydrobromic acid should require 10 Cc. of normal potassium hydrate V.S. (each cubic centimeter corresponding to 1 per cent of the absolute acid), phenolphtalein being used as indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Hydrobromic acid can not be administered internally, unless considerably diluted, on account of its powerfully corrosive qualities. Drs. D. C. Wade and J. M. Fothergill have found it efficacious in the *headache* that frequently follows the administration of quinine, as well as of ferruginous preparations. If given after the doses of the latter agents it prevents the sensations of fullness and pain that are apt to be occasioned by them, especially with those laboring under cerebral anemia This acid has also been found useful in all forms of *nervous excitability*, sometimes acting more efficaciously when in combination with quinine, which it readily dissolves. In *nervous exhaustion* from excessive use of tea, or alcoholic drinks, in *hysteria* from ovarian derangement, *nymphomania*, in *sleeplessness* from celibacy, in *gastric irritability*, in *menorrhagia*, and in the *vomiting of pregnancy* it has been administered with success. In association with quinine and digitalis it has been found of service in *enfeebled and excited conditions of the heart*; with spirit of chloroform and syrup of squill, it forms a pleasant and efficacious mixture in all *coughs*. It is a serviceable remedy in *nervous headache*, and according to De Schweinitz is useful in that form of *headache* resulting from *eye-strain*. Hale recommends it in *febrile disorders* with marked irritability and restlessness, the tongue being red and dry. When considerable *cerebral excitement* exists from physical or mental overwork, or during febrile affections its internal administration will prove highly serviceable. Dr. E. Woakes and others have derived great benefit from its use in cases of *tinnitus aurium*, resulting from the use of quinine, and from congestion of the parts, especially in those instances in which the tinnitus was of a pulsating, or knocking, character; doses of 15 minims of the acid in water were repeated every 4 hours. This acid appears to possess the therapeutical virtues common to the bromides of potassium and of sodium, although less persistent in its action; and unlike them, it possesses the advantage of not occasioning the troublesome acneiform eruption so often following their administration. *Epilepsy*, so frequently improved under the use of the alkaline bromides, is rendered worse by the administration of hydrobromic acid. Hydrobromate of quinine has been found a much better form, in solution, than the sulphate, for subcutaneous injection. Dose of diluted hydrobromic acid (*U. S. P.*) containing 10 per cent absolute acid, 10 drops to flʒiij, in sweetened water if preferred; quinine hydrobromate grains 1 to 20.

Specific Indications and Uses.—Dry red tongue, headache from cerebral hyperemia, delirium, pyrexia, tinnitus aurium, and especially when resulting from cinchonism; dull pain in the abdomen, with fretfulness and peevishness.

ACIDUM HYDROCHLORICUM (U. S. P.)—HYDROCHLORIC ACID.

FORMULA: HCl. MOLECULAR WEIGHT: 36.37.

SYNONYMS: *Hydrogen chloride, Muriatic acid, Acidum muriaticum, Acidum chlorhydricum, Acidum hydrochloratum, Marine acid, Chlorhydric acid, Spirit of salt, Spirit of sea-salt.*

"A liquid composed of 31.9 per cent, by weight, of absolute hydrochloric acid (HCl=36.37), and 68.1 per cent of water. Hydrochloric acid should be kept in dark, amber-colored, glass-stoppered bottles" (*U. S. P.*).

Source and History.—Hydrochloric acid was first made, and named the spirit of salt, by the monk, Basil Valentine, and its chemical composition determined by Davy in 1810. It is found in nature, in a free condition, in volcanic gases, and in the gastric juice of mammals. In the form of metal salts, called chlorides, it exists in many minerals, the most conspicuous and useful of which is common salt, hence its large distribution throughout sea-water. Hydrochloric acid is manufactured on an enormous scale in England, as a by-product in the production of sodium carbonate and potash. When the English factories were first established, the importance of this substance was not recognized, and as large quantities of it were generated when common salt was treated with sulphuric acid, it was allowed to pass up the chimneys and go to waste. This escaping gas soon became a nuisance, disturbing all vegetation in the neighborhood for miles around, and legislative interference became necessary. Laws were passed by Parliament to compel the manufacturers to prevent the escape of the gas. The latter found that by bringing the gas into contact with water, it was absorbed, yielding an impure hydrochloric acid, and in this instance the prohibitory law resulted in immense profit to those against whom the ordinance was passed.

Preparation.—Crude hydrochloric acid is produced by the English manufacturers, by allowing the gas which is evolved in the process of converting common salt into sulphates, to be absorbed by water. The gas is passed through coke (packed in a long, upright cylinder) through which water is allowed to trickle, and the gas having great affinity for moisture, is dissolved in it. In order to obtain a purer product, the gas is allowed to pass through a series of stone receivers, the first one being empty to catch and retain any of the sulphuric acid or sodium sulphate that may be carried over. The other receivers are partially filled with water to collect and dissolve the gas after it has passed through the first receiver. To produce the gas, about 115 parts of common salt (sodium chloride) are saturated with 100 parts (by weight) of strong sulphuric acid. This mixture is heated in upright, cylindrical iron stills. At first about one-half of the HCl is liberated, and acid sulphate of sodium formed, but on heating to a point considerably above 200° C. (392° F.), the remaining sodium chloride is decomposed by the acid sodium sulphate, thus yielding the full amount of HCl. The residue left in the still is then dissolved in water and crystallized as Glauber's salt, or it may be used directly in making sal soda. A yellow color of variable intensity given the acid produced in this manner, is due to ferric chloride, which is dissolved in it to a slight extent, or it may be caused by organic contamination present in the materials used.

A purer acid for medicinal use, according to the *British Pharmacopœia*, may be prepared as follows: take 48 parts of dried sodium chloride, 44 (80 by weight) parts of sulphuric acid, 36 parts of water, and 50 parts of distilled water. Put the sodium chloride into a glass flask holding at least one gallon, and upon it pour a cooled mixture of the sulphuric acid in 32 ounces of water. A three-necked bottle (provided with a safety tube) containing the remaining 4 ounces of water, is then to be connected to the flask by means of corks and bent glass tubing. Apply heat to the flask, when the disengaged gas will be forced through the tube into the bottle, where it is washed, and by means of another glass tube passed again into a second bottle containing the distilled water.

Description.—I. Hydrochloric Acid Gas.—Specific gravity 1.2844. This is an irrespirable, colorless gas, intensely irritating to the broncho-pulmonary surfaces. Owing to its affinity for moisture, it gives rise to clouds of whitish vapor when exposed to the atmosphere. It is neither combustible nor a supporter of combustion. It reddens litmus and is strongly acid. Under a pressure of 40 atmospheres at 10° C. (50° F.), it condenses to *liquid hydrochloric acid*.

II. Crude Hydrochloric Acid.—An impure, aqueous solution of the gas, of a yellowish to a yellow color, due to the iron present as an impurity. It should not contain arsenic, which is sometimes present as arsenic terchloride, derived from the sulphuric acid employed in making hydrochloric acid. Arsenic, if present, may be separated by adding to 10 parts of the undiluted acid, 1 part of stannous chloride. Metallic arsenic will be thrown down as a brownish precipitate, if the mixture be either heated or allowed to stand for a short time. Filter the liquid and distill. This method is a very delicate test, showing the presence of a millionth part of the arsenic (Bettendorff, *A. J. P.*, 1871, p. 222). Copper and mercury also free it from arsenic, or the diluted acid may be treated with hydrogen sulphide, when arsenic tersulphide will be precipitated.

III. Acidum Hydrochloricum Dilutum (*U. S. P.*). *Diluted hydrochloric acid, Diluted muriatic acid.*—"Hydrochloric acid, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; distilled water, two hundred and nineteen grammes (219 Gm.) [7 ozs. av., 317 grs.]; to make three hundred and nineteen grammes (319 Gm.) [11 ozs. av., 111 grs]. Mix them. Keep the product in glass-stoppered bottles. Diluted hydrochloric acid contains 10 per cent of absolute hydrochloric acid. Specific gravity about 1.050 at 15° C. (59° F.). It does not fume in the air, and is without odor, but otherwise it corresponds in properties to hydrochloric acid (see *Acidum Hydrochloricum*), and should conform to the same reactions and tests. To neutralize 3.64 Gm. of diluted hydrochloric acid should require 10 Cc. of normal potassium hydrate V.S. (each cubic centimeter corresponding to 1 per cent of the absolute acid), phenolphtalein being used as indicator"—(*U. S. P.*).

IV. Acidum Hydrochloricum (*U. S. P.*). *Hydrochloric acid.*—This is an aqueous solution containing 31.9 per cent of absolute hydrochloric acid. It is "a colorless, fuming liquid, of a pungent odor, and an intensely acid taste. Fumes and odor disappear on diluting the acid with 2 volumes of water. Specific gravity about 1.163 at 15° C. (59° F.). Miscible, in all proportions, in water and alcohol. On heating it, at first a stronger acid passes off, until, at 110° C. (230° F.), a liquid containing 20.18 per cent of the absolute acid remains (specific gravity about 1.102 at 15° C.), which distills unchanged, leaving no residue, if the acid was perfectly pure. With litmus paper it shows an intensely acid reaction, even after great dilution. Heated with manganese dioxide, it gives off chlorine"—(*U. S. P.*).

Tests.—With silver nitrate T.S. it yields a white, curdy precipitate, insoluble in nitric acid, but readily soluble in ammonia water, forming a colorless liquid (absence of copper). If 10 Cc. of the acid be evaporated from a platinum or porcelain capsule, not more than a bare trace of residue should be left (limit of non-volatile impurities). A few drops of chloroform, added to 1 Cc. of hydrochloric acid diluted with 2 Cc. of water, should not become colored, either at once, or after the addition of a few drops of freshly prepared chlorine water, or of a granule of potassium chlorate (absence of iodine or bromine). If 1 Cc. of the acid be diluted with 5 Cc. of water, and 0.5 Cc. of zinc-iodide-starch T.S. added, no blue color should appear (absence of chlorine or bromine). On adding 1 Cc. of stannous chloride T.S. (see *List of Reagents*, Bettendorff's Test for Arsenic), together with a small piece of pure tin-foil, to 1 Cc. of the acid, no coloration should occur within one hour (limit of arsenic). If 1 Cc. of the acid be diluted with 5 Cc. of water, and a few drops of barium chloride T.S. added, no precipitate or turbidity should appear within one hour (absence of sulphuric acid), nor should the addition to this mixture of a few drops of decinormal iodine V.S. produce any turbidity (absence of sulphurous acid). When a few Cc. of freshly saturated hydrogen sulphide T.S. are poured carefully on top of an equal volume of hydrochloric acid, no color should develop at the zone of contact (absence of thallium, arsenic, lead, etc.). If 1 Cc. of hydrochloric acid be slightly supersaturated with ammonia water, and 1 Cc. of ammonium sulphide T.S. added, neither a color nor a turbidity should appear (absence of iron, aluminum, etc.). To neutralize 3.64 Gm. of hydrochloric acid, diluted with 10 Cc. of water, should require 31.9 Cc. of normal potassium hydrate V.S. (each cubic centimeter corresponding to 1 per cent of the absolute acid), phenolphtalein being used as indicator"—(*U. S. P.*). It has been found that if the acid is reddish, selenium is present.

Action, Medical Uses, and Dosage.—Hydrochloric acid, when administered in small doses, creates gastric warmth and quickens the circulation. Decided intoxicating effects may be induced by it, while salivation may result from its continued use. The concentrated acid is violently irritant and corrosive, though it does not attack flesh so energetically as sulphuric acid. A poisonous dose produces intense, burning pain, and the faucial, œsophageal and gastric tissues are discolored. The tongue is swollen and intensely red, with occasional whitish patches. Great restlessness ensues, with a dry, feverish skin, sunken features, dilated pupils, small, irregular, wiry pulse, collapse and death resulting. Vomiting of bloody matter may occur, though more frequently only violent retching takes place. Whitish vapors may be evolved by mouth if the acid be recently swallowed. The acid may be identified if these vapors produce a flocculent, white material when brought in contact with ammonia water. After death the gastric tissues show marked evidence of intense inflammation. It is antidoted by the alkalies, preferably calcined magnesia. If possible, emetics and alkaline carbonates should be avoided, on account of their liability to rupture the already softened stomach by the over-distension occasioned by the copious liberation of carbonic acid gas. Chalk, whiting, soap, and oil are also antidotes to poisonous doses of hydrochloric acid, combating the gastro-enteritis in the usual way. According to Prof. Maisch, hydrogen sulphide is a direct antidote to the poisonous effects of the inhalation of chlorine. Concentrated hydrochloric acid is occasionally used as a topical application to *cancrum oris*, some obstinate *ulcers of the tongue* in certain *syphilitic* and *mercurio-syphilitic diseases*, in *phagedenic ulceration*, and also in *chilblains* or *frost-bites*. As a decalcifying agent it has been used in *caries* of the ossicles of the ear, as well as of the walls of the tympanum and external auditory canal, thus rendering their removal by operation less difficult. Foltz applies it with a broom-straw. Internally it is always diluted, so as to reduce its specific gravity to about 1.038, and which may be effected by adding 1 fluid ounce of the strong acid to 3 fluid ounces of distilled water. The official diluted acid is usually prescribed. The diluted acid has been used as a gargle for *elongated uvula*, *aphthæ*, and the *sore throat of scarlatina*. Internally it has been administered in *typhus* and *typhoid febrile diseases*, *malignant scarlet fever*, some forms of *dyspepsia*, and in *torpor of the liver;* also as a tonic in cases of *phosphatic urine*.

In the use of this agent we are governed by the specific indications, which are a deep-red mucous membrane, with a tendency to decay of the tissues; a marked depravation of the body fluids, as is evidenced by the raw, slick, beef-like tongue, or the dark-red or dusky, dry and fissured tongue, and the tendency to dark, brownish coloration and deposits, as sordes, upon the lips, teeth and tongue. All the exudations have a dark color. The temperature may be high and yet sedatives fail to act. With these conditions the acid acts kindly, the temperature falls, and the way is paved for the administration of other indicated drugs. These conditions may obtain in low states of any of the *fevers* from continued to typhoid. Hydrochloric acid is more often indicated in acute than in chronic diseases, and here it is that its effects of allaying irritation and acting as an antizymotic are marked. In *digestive disorders* it is especially applicable. The gastric juice itself contains this acid, and the cases requiring it are those in which the secretion of the natural acid is deficient. There may be nausea, vomiting, pyrosis, and stomatitis; greasy yellow, or brown eructations, with a bitter, unpleasant taste; and the breath is pungent and hot. These, together with the characteristic coloration of the membranes, point clearly to its use, whether it be a simple *indigestion* or advanced *dyspepsia*. *Intestinal indigestion, fermentative diarrhœa, catarrhal intestinal disorders of children, malignant dysentery,* or any bowel disorder with deep-red membranes and tendency to blood disintegration, are alike improved under its use. *Pneumonia, rheumatism,* and *diphtheria* occasionally need hydrochloric acid. In *phthisis* it checks septic changes and acts as a tonic in the processes of digestion and assimilation. *Purpura hæmorrhagica, hepatic disorders,* and *erysipelas* are benefited by it when indicated. Webster calls attention to the fact that when the dark-red coloration of membranes is due to cardiac complications or other conditions tending to imperfect decarbonization of the blood, the mere indication, "red coloration," does not hold good. As specifically employed, the dose of the acid (pure or diluted) should be such that the aqueous dilution should be pleasantly sour; it may be sweetened if desired. The dose of diluted hydrochloric acid varies from 10 drops to a fluid drachm, which should be added to 4 or 6 fluid ounces of water, and sucked through a quill or glass tube, to prevent its injuring the teeth.

Specific Indications and Uses.—Deep-red, dry and contracted tongue, with a brownish coating; tongue contracted, with a central brownish stripe, or with a fissured, brownish coat; sordes; membranes dark-red; or the tongue is dark or dusky-red, moderately full and slick, having the appearance of a piece of spoiled beefsteak; pungent heat of skin, slow digestion, and nervous prostration.

ACIDUM HYDROCYANICUM DILUTUM (U. S. P.)—DILUTED HYDROCYANIC ACID.

FORMULA: (Absolute hydrocyanic acid) HCN. MOLECULAR WEIGHT: 26.98.

SYNONYMS: *Prussic acid, Acidum hydrocyanatum, Acidum borussicum, Cyanhydric acid.*

Diluted hydrocyanic acid is an aqueous solution containing 2 per cent, by weight, of absolute hydrocyanic acid ($HCN=26.98$) and 98 per cent of water (*U. S. P.*).

Source.—Scheele discovered this acid in 1782. It is contained in many trees and shrubs of the natural order *Rosaceæ*, principally in the sub-orders *Amygdaleæ* and *Pomeæ*, where it is found in the seeds, barks, leaves and flowers, existing uncombined largely in the fluid portions of the plant. It is this acid which, in combination with benzaldehyde, gives to the almond and to peach seeds and leaves their pleasant and characteristic flavor.

Preparation.—"Potassium ferrocyanide, in coarse powder, twenty grammes (20 Gm.) [309 grs.]; sulphuric acid, eight cubic centimeters (8 Cc.) [130 ♏]; water, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; distilled water, a sufficient quantity. Place the potassium ferrocyanide in a tubulated retort, and add to it forty cubic centimeters (40 Cc.) [1 fl℥, 169 ♏] of water. Connect the neck of the retort (which is to be directed upward), by means of a bent tube, with a well-cooled condenser, the delivery tube of which terminates in a receiver surrounded with ice-cold water, and containing sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏] of distilled water. All the joints of the apparatus, except the neck of the receiver, having been made air-tight by means of well-fitting corks, pour into the retort, through the tubulure, the sulphuric acid, previously diluted with twenty-five cubic centimeters (25 Cc.) [406 ♏] of water. Gently mix the contents of the retort and then heat it in a sand-bath, so as to keep the liquid in brisk ebullition, until about one-half of its volume has passed over into the receiver. Detach the receiver, and assay a small portion of the contents by the method given below. Then add to the remainder so much distilled water as may be required to bring the product to the strength of 2 per cent, by weight, of absolute hydrocyanic acid. Diluted hydrocyanic acid may also be prepared, extemporaneously, in the following manner: silver cyanide, six grammes (6 Gm.) [93 grs.]; hydrochloric acid, five cubic centimeters (5 Cc.) [81 ♏]; distilled water, fifty-five cubic centimeters (55 Cc.) [1 fl℥, 426 ♏]. Mix the hydrchloric acid with the distilled water, add the silver cyanide, and shake the whole together in a glass-stoppered bottle. When the precipitate has subsided, pour off the clear liquid. Diluted hydrocyanic acid should be kept in small, dark amber-colored, cork-stoppered vials, in a cool place"—(*U. S. P.*).

Wittstein gives the following formula for making diluted hydrocyanic acid, which forms quite a permanent acid, one that may be freely exposed to the light for ten or twelve weeks without any apparent change: to 16 ounces of distilled water add 4 ounces of ferrocyanide of potassium; when dissolved, add a mixture, cold, of 12 ounces of alcohol, specific gravity 0.840, with 3 ounces of sulphuric acid. Let this mixture stand for 24 hours, with occasional agitation. By means of a strainer separate the crystalline precipitate, introduce the clear liquid into a retort which has an inch in depth of its bottom covered with clean quartz-sand, in order to check the thumping during the distillation, and distill off 20 fluid ounces. Reduce the distillate to the proper strength by the appropriate tests.

Description and Tests.—Concentrated or anhydrous hydrocyanic acid is not used in medicine. The medicinal acid is a clear fluid, having a peculiar, penetrating, diffusive odor, and a peculiar, rather disagreeable taste, both the "odor and taste resembling those of bitter-almonds"—(*U. S. P.*). It is very poisonous (on which account it should be tasted with great caution), is very volatile, imparts a slight red tinge to litmus paper which is not permanent, and is decomposed by the action of light, giving rise to a black substance, paracyanogen. Vials in which it is placed should be small, and of a dark-amber color, and well-stopped with cork. It should always be kept in a cool situation. "It is completely volatilized by heat"—(*U. S. P.*). If the acid strongly reddens litmus it contains some other acid; if it be sulphuric acid, a solution of nitrate of barium, which occasions no precipitate in the pure acid, will yield a white deposit of sulphate of barium, insoluble in nitric acid. If hydrochloric acid be present, nitrate of silver forms a white deposit of chloride of silver insoluble in boiling nitric acid, whereas the white cyanide of silver is soluble in nitric acid at 100° C. (212° F.). It is soluble in water, ether, and alcohol in all proportions. Hydrocyanic acid may be known: 1. By its peculiar odor; 2. by its forming prussian blue when, after having accurately saturated it with caustic potash, a solution of sulphate, and of chloride of iron is added to it, and to the precipitate thus procured some diluted sulphuric or hydrochloric acid be added; 3. the white precipitate of cyanide of silver, caused by the addition of a solution of nitrate of silver, is soluble in boiling concentrated nitric acid; 4. a very delicate reaction is as follows: place a few drops of the suspected liquid upon a watch glass, add a few drops of ammonia and yellow ammonium sulphide, warm on a water-bath to decompose the excess of the latter; when the liquid is colorless, render faintly acid with hydrochloric acid and add some ferric chloride; a blood-red coloration of ferric sulphocyanide will appear if HCN was originally present. The following is Schönbein's test for the millionth part of a drop of hydrocyanic acid in water, or in vapor in the atmosphere: dissolve 3 grammes (46⅓ troy grains) of guaiac resin in 100 grammes (1543⅓ troy grains) of rectified alcohol. Moisten enough filtering-paper in this solution to absorb the whole of it; the paper should remain white. Also make a solution of sulphate of copper 1 decigramme (1½ troy grains) to 50 grammes (771⅔ troy grains) of distilled water. When it is desired to use this test, cut off a small strip of this paper, moisten it with the solution of sulphate of copper, and place it in contact with the suspected fluid or vapor, and if hydrocyanic acid be present, the paper becomes blue instantly.

Hydrocyanic acid is incompatible with the mineral acids, the salts of iron, the sulphides, chlorine, the oxides of mercury, of antimony, nitrate of silver, etc. Light decomposes it, hence it should always be kept in bottles that are darkened or covered so as to prevent the rays of light from passing into them. In using this acid medicinally, care should always be taken to procure the *diluted* preparation. Scheele's medicinal hydrocyanic acid is stronger than the official diluted acid of the *United States Pharmacopœia*, as 2 is to 5. A very weak hydrocyanic acid is less liable to decomposition than the stronger preparations, hence it is that such preparations as Scheele's (above) is unfitted for medicinal use, on account of the readiness with which it loses strength. Prof. J. U. Lloyd has shown that a hydrocyanic acid made with a portion of alcohol will retain its properties unaltered and without apparent loss, for at least three years "If to 1 Cc. of the acid, rendered alkaline by potassium hydrate T.S., a few drops, each, of ferrous sulphate T.S. and ferric chloride T.S. be added, and the mixture then acidulated with hydrochloric acid, a blue precipitate will be formed. To ascertain the percentage strength, mix in a flask (of the capacity of about 100 Cc.) 0.27 Gm. of hydrocyanic acid (obtained by distillation as above directed) with sufficient water and magnesia to make an opaque mixture of about 10 Cc. Add to this 2 or 3 drops of potassium chromate T.S., and then, from a burette, decinormal silver nitrate V.S., until a red tint is produced which does not again disappear by shaking. Each cubic centimeter of silver nitrate V.S. used indicates 1 per cent of absolute hydrocyanic acid. After ascertaining the strength of the distillate, dilute it with distilled water so as to bring it to the strength of 2 per cent of absolute acid. Lastly, test the finished product again, when 1.35 Gm. of it should require, for complete precipitation, 10 Cc. of decinormal silver nitrate V.S."—(*U. S. P.*).

Action and Toxicology.—Prussic acid is one of the deadliest of known poisons. In small doses it produces in man, salivation, faucial irritation, epigastric warmth, bitter, hot taste, dizziness, light feeling in head, tinnitus, pain in head, numbness, vertigo, dusky countenance, drowsiness, staggering gait, præcordial constriction, and the pulse either increased with palpitation, or decreased in action. From such doses ulceration of the mouth, and salivation have occurred. In poisonous doses its effects are very rapid. When a half ounce of the ordinary solutions (2 to 4 per cent) is taken, the symptoms usually commence with swallowing, or quickly thereafter. The symptoms are rarely delayed beyond *one or two minutes* (Taylor). Faintness, vertigo, or more commonly insensibility, at once take place. Then follow fixation and glistening of the eyes, with dilatation of the pupils which light fails to affect, flaccid limbs, cold skin with clammy perspiration, dusky, turgid countenance, hot head, convulsive breathing at long intervals (appearing dead during the intervals), pulse imperceptible, involuntary evacuations, respiration slow, deep, and gasping, usually convulsive, though occasionally sobbing or heaving, and if there be profound coma, the breathing is stertorous. Usually in fatal cases, relaxation rather than convulsions, is the rule, though in occasional cases convulsions, or rigidity with set jaws, have been observed. The eyes retain their peculiar luster after death, and the congested state of the gastric membranes, as well as the engorgement of blood in the deeper veins, with empty arteries, and the purplish hue of the skin, are among the post-mortem appearances.

The smallest dose which has produced death is that equivalent to $\frac{9}{10}$ grain of the anhydrous acid, or 45 minims of the official solution. Time, 20 minutes; a healthy, adult female. The smallest fatal dose is therefore assumed to be 50 minims of the solution [2 per cent] (Taylor). Taylor compares the death to that of lightning, the patient either dies quickly, or recovers altogether. Seven drachms of the solution killed a physician in four or five minutes; and a single drop of the pure acid in the eye or throat of a strong dog killed the animal in a few seconds. The strong odor of bitter almonds is given off from the poisoned patient before and after death. Death may result from either respiratory or cardiac paralysis. If death does not take place in one hour, the patient will probably recover. The effects of potassium cyanide closely resemble those of prussic acid. In cases of poisoning by hydrocyanic acid, there is seldom time to administer an antidote; but when life is not extinct, we may confidently rely on the antidotes we possess. The theoretical antidote is ferrous sulphate. The best is that proposed in the *Lancet* for 1844, Vol. II., p. 41, by Messrs. T. & H. Smith, of Edinburgh, viz.: In a fluid ounce or two of water, dissolve carbonate of potassium 20 grains, and cause the patient to swallow it; and, immediately following this, administer a solution of sulphate of iron 10 grains, tincture of chloride of iron a fluid drachm, in a fluid ounce of water. This will convert about 2 grains of the strong acid into an insoluble prussian blue. While these are being prepared, the symptoms already produced will be best combated by ammonia inspired from a sponge, or taken, diluted, internally; by chlorine water, used by inhalation, and internally, in teaspoonful doses, diluted with water; cold affusion, dashing the water or pouring it from a height, more especially on the head and along the spinal column; and also artificial respiration and electricity.

Medical Uses and Dosage.—When largely *diluted* (2 per cent), it has been employed in medicine as a sedative to subdue *spasm*, and allay *nervous irritability*. It has been used to relieve severe *vomiting* and *purging*, to check *colliquative diarrhœa*, to cure *pertussis* and *spasmodic coughs*, *asthma*, *hysteria*, *chorea*, *dyspepsia* connected with morbid irritability of the stomach, etc.; also externally in several diseases of the skin. It has likewise been found beneficial in the *cough of consumptives*, *cardiac palpitations*, *hypertrophy of the heart*, and in *difficult breathing*. It is useful in *angina pectoris*, but not so valuable as amyl nitrite or glonoin. Minute doses relieve *congestive headache*. But, from its volatility, its variability of strength, and its proneness to decomposition, it will very frequently dissappoint the expectations of the practitioner, either by inducing fatal symptoms, or being wholly inert. The dose of the diluted acid is from 1 to 3 drops in water, mucilage or syrup.

Specific Indications and Uses.—"Elongated and pointed tongue with reddened tip and edges; uneasy sensations in the stomach" (Scudder), nausea, vomiting, gastric irritation and pain; vertigo; angina pectoris; cough of phthisis (palliative); gastric cough with scanty secretions. In the specific use of this drug, 5 minims of the official acid (2 per cent) are added to 4 fluid ounces of water, and teaspoonful doses of the mixture administered every 2 or 4 hours.

ACIDUM HYDROFLUORICUM.—HYDROFLUORIC ACID.

FORMULA: HF. MOLECULAR WEIGHT: 20.

SYNONYMS: *Hydrogen fluoride*, *Fluorhydric acid*, *Acidum fluorhydricum*.

Source and History.—Scheele discovered an impure hydrofluoric acid in 1771. It was subsequently obtained pure by Gay-Lussac and Thénard in 1808. Hydrofluoric acid is a derivative of the element fluorine, which occurs in *fluorspar* (calcium fluoride) and other minerals, as for instance *cryolite* ($Al_2Fl_{12}Na_6$). It is present to a slight extent in the bones of mammals, as fluoride of calcium, existing in human bone, according to Berzelius, to the extent of 2 parts in 100. It is also a constituent of the enamel of the teeth, and is found to some extent in both drinking and mineral waters.

Preparation.—The greatest care is necessary in the preparation of this acid. It is recorded that Prof. Nickles, of Naples, lost his life from the accidental inhalation of hydrofluoric acid vapors. To prepare it, powdered fluor-spar may be gently heated with sulphuric acid in a lead or platinum retort, and the resultant gas, which exhibits great avidity for moisture, may be conducted into lead or platinum receivers containing cold distilled water, the receptacles being kept very cool by immersion in a cold bath. *Cryolite* may be used in place of *fluor-spar*, but either should be free from silica.

Description.—Hydrofluoric acid of commerce is a solution of hydrofluoric acid gas in water, in which it is extremely soluble. It is a thin, colorless, liquid, emitting exceedingly dangerous vapors. The gas (in the presence of moisture only), or the aqueous solution, actively attacks glass on account of its strong attraction for silica, with which it forms silicon fluoride (SiF_4), and hydrofluosilicates of the bases contained in the glass. For this reason it is extensively used for etching upon glass. To illustrate its action a piece of glass may be coated with wax or paraffin, into which a design is scratched with a needle, leaving the surface of the glass free where traced. The glass may then be laid face downward over a mixture of equal parts of powdered fluor-spar and sulphuric acid contained in a leaden vessel, and gently heated in the open air, being extremely careful not to inhale any of the fumes. The gas attacks the glass in those parts not coated with wax, and leaves, on the surface of the plate, an opaque impression of the figure drawn. On account of this action on glass, it must be kept in leaden or rubber bottles.

Action, Medical Uses, and Dosage.—This acid has an intensely irritating action upon the respiratory organs, may produce spasm of the glottis, and has caused death. Allowed to come in contact with the skin, it powerfully corrodes it, producing a deep sore very difficult to heal, and exhibiting an intensely painful, aching sensation. The vesicles produced by it should be immediately evacuated and treated with a dilute solution of caustic potash. Even the vapor will produce painful sores under the finger nails. Fermentation and putrefaction are powerfully restrained by even so dilute a solution as 1 in 3000. From the fact that etchers upon glass seemed remarkably free from phthisis, several French physicians attributed their exemption to the use of this acid in their work. A series of trials was made to determine its usefulness in this complaint. A special chamber (22 Cc.) was constructed by Dujardin-Beaumetz in which he exposed consumptive patients to the vapor of 1 grain of the acid diffused from a leaden vessel by means of a water bath. Expectoration was lessened and the appetite somewhat increased, but beyond this no good results were apparent. It has been prescribed in *phthisis*, *pertussis*, *asthma*, and *diphtheria*, but without success; also in aneurism to slow the arterial action. Woakes claims to have cured seventeen out of twenty cases of *goitre* with it. Large doses, 15 to 60 minims, were given, largely diluted, 3 times a day. Other adjuvant treatment was also employed and particularly injections of iodine, and it is but fair to presume that much of the benefit was derived from the adjuvant treatment. The fluorides relieve pain without proving narcotic, quickly cause loss of appetite and gastric derangement even in very small doses, and speedily act as non-depressing emetics.

ACIDUM HYPOPHOSPHOROSUM DILUTUM (U. S. P.)—DILUTED HYPOPHOSPHOROUS ACID.

FORMULA: HPH_2O_2. MOLECULAR WEIGHT: 65.88.

A liquid composed of about 10 per cent, by weight, of absolute hypophosphorous acid (HPH_2O_2=65.88), and about 90 per cent of water (*U. S. P.*).

Preparation.—Hypophosphorous acid may be prepared from any of the hypophosphites which are soluble. The process of Moerk is as follows: Take calcium hypophosphite 69 parts, boiling water 450 parts. Solve. Crystallized oxalic acid 50.4 parts, boiling water 200 parts. Solve. Mix the two solutions, boil for one-half hour, cool, filter by means of cotton, and wash the precipitate with cold water. Finally evaporate the filtrate to 88 parts. This process yields a 60 per cent acid, and as diluted hypophosphoric acid of the Pharmacopœia contains but 10 per cent of absolute acid, it may readily be prepared by diluting the above 60 per cent acid to the desired strength by the addition of distilled water. The *National Formulary* directs its preparation as follows:

ACIDUM HYPOPHOSPHOROSUM DILUTUM (*N. F.*), *Diluted hypophosphorous acid.—Formulary number*, 6: "Potassium hypophosphite two hundred and eight grammes (208 Gm.) [7 ozs. av., 147 grs.]; tartaric acid three hundred grammes (300 Gm.) [10 ozs. av., 255 grs.]; distilled water five hundred and eighty-eight grammes (588 Gm.) [1 lb. av., 4 ozs., 324 grs.]; diluted alcohol (*U. S. P.*) six hundred grammes (600 Gm.) [1 lb. av., 5 ozs., 72 grs.]. Dissolve the potassium hypophosphite in the distilled water, and the tartaric acid in the diluted alcohol. Mix the two solutions in a flask, cork the latter well, and put it aside in a cold place during twelve hours. Then carefully decant the liquid into a funnel, the neck of which contains a pellet of absorbent cotton, or, if necessary, pass the liquid through a filter, care being taken that it shall not suffer loss by evaporation. Weigh the filtrate, which contains 10 per cent of hypophosphorous acid, in a tared capsule, and evaporate the alcohol by means of a water bath, at a temperature not exceeding 60° C. (140° F.). Then allow the liquid to cool, and add enough distilled water to restore the original weight of the filtrate. Preserve the product in well-stoppered bottles.

"*Note.*—This acid is now official in the *U. S. P.;* but the formula is retained because it may be now and then convenient or necessary to make it. If a 50 per cent acid is required, the concentration may be cautiously continued until the desired percentage has been attained. A 50 per cent acid has a specific gravity of about 1.406 at 15° C. (59° F.)"—(*Nat. Form.*).

Description and Tests.—The *U. S. P.* thus describes and gives tests for this acid: "A colorless liquid, without odor, and having an acid taste. Specific gravity about 1.046 at 15° C. (59° F.). Miscible in all proportions with water. When heated in a porcelain capsule, it evaporates, losing at first principally water, and becoming more concentrated. On further heating it decomposes, forming hydrogen phosphide which ignites, and phosphoric acid. The pasty residue finally reddens, ignites, and the last portions of phosphorus burn out at higher heat. From silver nitrate T.S. it reduces black metallic silver. When the acid is gently heated with copper sulphate T.S., a yellow precipitate of copper hydride falls, which rapidly assumes a reddish-brown color. The addition of hydrogen sulphide T.S. to the acid should produce neither a precipitate nor a coloration (absence of lead, etc.). If some of the acid be neutralized with ammonia water, separate portions of the liquid should not yield a precipitate with ammonium sulphide T.S. (absence of iron, etc.), nor with ammonium oxalate T.S. (absence of calcium); nor should more than a slight turbidity be produced by barium chloride T.S. (limit of phosphoric, sulphuric, oxalic and tartaric acids). Neither platinic chloride T.S. nor sodium cobaltic nitrite T.S. should produce more than a slight yellow turbidity in the diluted acid (limit of potassium). If 0.5 Gm. of diluted hypophosphorous acid be mixed with 7 Cc. of sulphuric acid and 35 Cc. of decinormal potassium permanganate V.S., and the mixture boiled for 15 minutes, it should require about 4.7 Cc. of decinormal oxalic acid V.S. to discharge the red color, corresponding to about 10 per cent of the absolute hypophosphorous acid. To neutralize 6.6 Gm. of diluted hypophosphorous acid should require about 10 Cc. of normal potassium hydrate V.S. (each cubic centimeter corresponding to 1 per cent of the absolute acid), phenolphtalein being used as indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Reputed tonic in *nervous debility*, though seldom if ever used, except in combination with other tonic mixtures and syrups. The dose ranges from 10 to 60 minims.

ACIDUM LACTICUM (U. S. P.)—LACTIC ACID.

FORMULA: $HC_3H_5O_3$. MOLECULAR WEIGHT: 89.79.

SYNONYMS: *Isolactic acid*, *Oxypropionic acid*, *Ethylidene-lactic acid*, *Ethidene-lactic acid.*

"An organic acid, usually obtained by subjecting milk-sugar or grape-sugar to lactic fermentation; composed of 75 per cent, by weight, of absolute lactic acid [$HC_3H_5O_3$=89.79], and 25 per cent of water"—(*U. S. P.*).

Source and History.—Lactic acid is formed from milk-sugar by the process of "lactic fermentation" induced by the presence of casein. It is the acid principle of sour milk and is produced when vegetable and other tissues become soured, as in sauerkraut, or when beet juice, or rice-water are allowed to ferment, and it may also be obtained from refuse liquor produced in the manufacture of starch and the tanning of leather. It is found in natural form in the juice of the bittersweet (*Solanum Dulcamara*) (Wittstein), and occurs normally in some of the fluids of the body, notably the gastric juice; also in certain pathological conditions. That it exists in the gastric juice, however, is contradicted by Maly and others. This acid was first obtained from sour milk by Scheele in 1780. Berzelius discovered it in a modified form in meat juices in 1807 and named it *sarco-*

lactic acid, which, however, has been shown to be a combination of *paralactic* and *ethylenelactic acids*. These acids are isomeric with the lactic acid of fermentation, but behave differently toward polarized light. The greater portion of lactic acid comes to us from Germany, though a considerable amount is now prepared in the United States. Alcohol, mannit, a gum, and several other acids may be obtained in making lactic acid.

Preparation.—This acid is usually prepared by allowing milk-sugar to digest for a few weeks, in the sunlight, at a temperature of about 30° C. (86° F.), in a mixture of milk, rotten cheese, and chalk. The casein of the cheese induces lactic fermentation, the resulting acid being neutralized by the calcium compound, forming calcium lactate. The calcium salt is then crystallized, decomposed with oxalic acid by which calcium oxalate is formed, and lactic acid is liberated. At no time should the temperature fall below 20° C. (68° F.), or rise above 40° C. (104° F.), for at the former the formation of the acid is retarded and at the latter a certain amount of butyric acid is produced.

A more rapid process than that customarily followed, and one which gives a greater yield, is that of Kiliani (1882). Cane sugar is converted into invert sugar by dissolving in two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.] of water, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.] of cane sugar, and boiling it with ten cubic centimeters (10 Cc.) [162 ♏] of sulphuric acid. To this is gradually added four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of a solution of equal parts of sodium hydroxide and water. This is heated to 60° C. (140° F.), or 70° C. (158° F.), until it no longer reacts, or gives but a very faint greenish color, with Fehling's test solution. Sulphuric acid is then added to neutralization, sulphate of sodium crystallizes, and 93 per cent alcohol is added until the remainder ceases to throw down a precipitate. Then over a sand-bath one-half of the alcoholic solution is boiled and neutralized with carbonate of zinc, and, while boiling hot, filtered, added to the other half, and allowed to cool. Lactate of zinc at once begins to crystallize, requiring about 36 hours for completion. The crystals are expressed and recrystallized. This salt is then treated with oxalic acid, and lactic acid results. When well-soured sauerkraut is boiled with zinc carbonate, lactate of zinc is formed.

ACIDUM LACTICUM DILUTUM (*Br.*) *Diluted lactic acid*: "Lactic acid 3 fluid ounces (Imp.); distilled water, q. s. to make 1 pint (Imp.). Mix"—(*Brit. Phar.*).

Description and Tests.—Pure lactic acid is colorless and odorless. The official preparation is "a colorless, syrupy liquid, odorless, of a purely acid taste, and absorbing moisture on exposure to damp air. Specific gravity, about 1.213 at 15° C. (59° F.). Freely miscible with water, alcohol, or ether; insoluble in chloroform, benzin, or carbon disulphide. Lactic acid is not vaporized by a heat below 160° C. (320° F.); at a higher temperature it emits inflammable vapors, and is finally dissipated. 5 Gm., after combustion, should not leave more than 0.05 Gm. of fixed residue. Lactic acid has a strongly acid reaction"—(*U. S. P.*).

Albumen is coagulated by it. Treated with nitric acid it yields oxalic acid. It gives rise to the lactates, and when treated with chromic acid, acetic and formic acids result. Heated to 150° C. (302° F.), it is converted into the anhydride, *lactide* ($C_3H_4O_2$=concrete lactic acid), a crystalline solid. When painted upon substances it dries to form a smooth varnish which gradually absorbs moisture from the air.

"On adding some potassium permanganate to a mixture of equal volumes of lactic and sulphuric acids, and gently heating, the odor of aldehyde will become perceptible. 10 Cc. of a 1 per cent aqueous solution of the acid should not be rendered opalescent by the addition of 1 Cc. of silver nitrate T.S. (limit of chloride). 10 Cc. of a 10 per cent aqueous solution should remain unaffected by the addition of 1 Cc. of barium chloride T.S. (absence of sulphate), or by 1 Cc. of copper sulphate T.S. (absence of sarcolactic acid), or after supersaturation with ammonia by 1 Cc. of ammonium sulphide T.S. (absence of iron, lead, etc.). On adding a few drops of lactic acid to 10 Cc. of hot alkaline cupric tartaric V.S., no red cuprous oxide should be separated (absence of sugars). If a small portion of the acid be heated with an excess of zinc carbonate, the mixture dried at 100° C. (212° F.), and then extracted with absolute alcohol, upon evaporation of the latter no sweet residue should remain (absence of glycerin). On mixing equal volumes of lactic and colorless, concentrated sulphuric acids in a small, clean, glass-stoppered vial, the mixture should not acquire a tint deeper than a pale straw-color (absence of more than traces of organic impurities). To neutralize 4.5 Gm. of lactic acid should require 37.5 Cc. of potassium hydrate V.S. (each cubic centimeter corresponding to 2 per cent of absolute acid), phenolphtalein being used as indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Lactic acid is a normal constituent of the gastric juice, and to its excess in the system has been attributed the cause of rheumatism; but whether it is the cause or a result has not yet been definitely determined. Very large doses are reputed hypnotic (Mendel).

Lactic acid quickly dissolves oxalate of calcium and phosphate of calcium, especially that which is contained in the bones, and hence has been recommended in oxalic and phosphatic *urinary deposits*. It has not, until quite recently, been much employed in medicine in its uncombined state, but has been used in the preparation of lactate of iron and lactate of quinine. According to Pereira this acid was introduced into medicine by Magendie, who suggested its employment in *dyspepsia* and in *phosphatic urine*. It has more recently been advised in *gout*. The dose is from half a drachm to 2 drachms, in sweetened water, or in the form of lozenges. It is better to take the acid during or immediately following meals. Added to pepsin, as prepared for therapeutical use, this acid renders it still more valuable as a solvent of the food received into the stomach. According to Bricheteau and Adrian, the false membranes of *diphtheria*, *croup*, *pseudo-membranous bronchitis*, etc., are soluble in a solution of lactic acid, forming a translucent liquid with almost imperceptible fragments of a gelatiniform substance floating upon its surface and looking like froth, while acetic, citric, formic, and chromic acids have no such action. They recommend in *croup*, *diphtheria*, etc., a gargle composed of lactic acid 5 parts, water 100 parts, and orange syrup 30 parts; in conjunction with the use of the same, minus the syrup, in the form of spray thrown upon the affected parts.

Lactic acid has been used topically in ulcerated states of the nasal fossæ and in *suppurative otitis*, though in the latter disease the results are not commensurate with the irritation of the external canal which it occasions. In *caries* of the aural bony structures it has been advised, but it is open to the same objection mentioned above. It fails to destroy dense granulations of the tympanum. Webster (*Dynam. Therap.*) declares it second only to acetic acid in obstinate *tinea versicolor*, and states that it does not attack the true skin. "*Liver spots*" and *ephilides* are said by him to be removed by the application of the concentrated acid, the procedure to be repeated until the epidermis and underlying pigment are removed in such a manner as to avoid cicatrization. The lesions are then dressed with mild zinc ointment or a similar dressing. Epithelial excrescences, such as *warts*, *horny growths*, and *tylosis* of the palms and soles, are removed by the continued application of the acid with a camel's-hair pencil.

The most important use of this remedy, however, is in *gastro-intestinal affections*. Where an acid is indicated and the digestive powers are feeble this acid should be preferred to hydrochloric and other acids. It may therefore be employed in feeble digestion and even in advanced *dyspepsia*. It is a well-known fact that delicate stomachs that can scarcely retain any other food, kindly receive buttermilk and coagulated or "clabbered" milk, and this often forms an excellent means of administration. The irritable stomach with evident lack of, or but scanty secretion of gastric juice, clearly points to its use. Its action in *infantile diarrhœa* with a painful and irritable stomach and the passage of green evacuations is most positive. It should be given in water that has been boiled and may be sweetened if desired. The dose should be regulated so that the little patient receives from ½ to 1 drop at a dose. The dose of lactic acid may range from a half drop to a half ounce in 24 hours. The small doses, from one-half drop to 5 drops, are those which act specifically.

Specific Indications and Uses.—Gastric irritation with thirst, deep-red tongue, and diarrhœa with green stools, itching skin, and cutaneous eruptions, especially when arising from gastric disturbances.

ACIDUM NITRICUM (U. S. P.)—NITRIC ACID.

FORMULA: HNO_3. MOLECULAR WEIGHT: 62.89.

SYNONYMS: *Aqua fortis, Azotic acid, Spirit of nitre, Acidum nitri, Acidum azoticum, Spiritus nitri acidus.*

"A liquid composed of 68 per cent, by weight, of absolute nitric acid (HNO_3 =62.89) and 32 per cent of water. Nitric acid should be kept in dark amber-colored, glass-stoppered bottles"—(*U. S. P.*).

Source.—This acid was known to the ancient alchemists as "Aqua fortis." It was prepared by Geber, in the eighth century, by distilling a mixture of niter, blue vitriol, and alum. Cavendish determined its composition in 1785. Nitric acid is present to a slight extent in a moist atmosphere, and particularly in rain-water falling during a thunder-shower. It is found in the fluids of some plants, and occurs in large quantities in alkaline combination where the oxidizing process of "nitrification" converts the nitrogen of decaying animal and vegetable tissues into nitric acid. In this silent but continuous manner large deposits of nitrates are formed in the earth, such as the "niter beds" of India and along the coast of Chili and Peru. Spring-water or surface well-water which has filtered through soil containing decomposed animal matter often contains nitrates in solution, and is unfit for drinking purposes.

Preparation.—Nitric acid is generally procured on a large scale by submitting to distillation either nitrate of potassium or of sodium with sulphuric acid, in an apparatus somewhat similar to that used in the distillation of oil of vitriol. The sodium or potassium unites with the sulphuric acid to form a sulphate, while the nitric acid is liberated in the form of gas, which is passed into a vessel of water, this fluid absorbing it and acquiring acid properties. According to Deville, dry or uncombined nitric acid (nitrogen pentoxide, or nitric anhydride N_2O_5) may be obtained by decomposing dry nitrate of silver by dry chlorine gas. It forms large, brilliant, colorless crystals, belonging to the right-rhombic prismatic system, which fuse at 24.4° C. (85° F.) and boil at 45° C. (113° F.).

Description and Tests.—Nitric acid is met with of various strengths, as follows:

I. MONOHYDRATED NITRIC ACID, *Hydrate of nitrogen.*—This, the strongest of the nitric acids, has been abandoned, owing to the difficulties attending its preparation, and to its instability. (For detailed description of it see *Am. Disp.*, 11th ed.)

II. CRUDE NITRIC ACID.—This acid is frequently called *Aqua fortis*, and is of two strengths—*Single aqua fortis* (spec. gr., 1.21) and *Double aqua fortis* (spec. gr., 1.37). It is colorless, or yellowish, and is employed in industrial processes, and occasionally in preparing certain pharmaceutical preparations.

III. ACIDUM NITRICUM (*U. S. P.*), *Nitric acid*, according to the *United States Pharmacopœia*, contains 68 per cent of absolute nitric acid. It colors the skin and nails yellow, and if long enough in contact with the tissues it will produce deep and slowly-healing sores. "A colorless, fuming liquid, very caustic and corrosive, and having a peculiar, somewhat suffocating odor. Specific gravity, about 1.414 at 15° C. (59° F.). It boils at 120.5° C. (248.9° F.), and is completely volatilized. It dissolves copper, mercury, silver, and other metals with evolution of red vapors, and stains woolen fabrics and animal tissues a bright yellow. Heated with indigo T.S., it discharges the blue color of the latter. Even when highly diluted, it shows an intensely acid reaction with litmus paper.

"If 1 Cc. of nitric acid be slightly supersaturated with ammonia water, no precipitate should be formed (absence of iron, or much lead); nor should the liquid assume a blue tint (copper); nor should the further addition of a few drops of colorless ammonium sulphide T.S. produce any coloration or precipitate (lead, iron, copper, etc.). On diluting some of the acid with five times its volume of water, a portion of this liquid, when gently heated and treated with freshly-prepared hydrogen sulphide T.S., should not show a colored precipitate (absence of lead, arsenic, copper); nor should any precipitate be produced in other portions of the diluted acid by barium chloride T.S. (absence of sulphuric acid), or by silver nitrate T.S. (absence of hydrochloric acid). If the diluted acid be shaken with a few drops of chloroform, the latter should remain colorless (absence of iodine or bromine), even after introduction of a small piece of metallic zinc (absence of iodic or bromic acid). To neutralize 3.145 Gm. of nitric acid should require 34 Cc. of normal potassium hydrate V.S. (each cubic centimeter corresponding to 2 per cent of absolute acid), phenolphtalein being used as indicator" —(*U. S. P.*).

The presence of nitric acid or nitrates in a liquid may also be ascertained by carefully adding about one-half its volume of pure sulphuric acid, and when the mixture is cold, a layer of solution of ferrous sulphate; if nitric acid be present a purplish or brownish color will appear where the two liquids meet.

IV. ACIDUM NITRICUM DILUTUM (*U. S. P.*), *Diluted nitric acid.*—Take " nitric acid, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; distilled water, five hundred and eighty grammes (580 Gm.) [1 lb. av., 4 ozs., 201 grs.]; to make six hundred and eighty grammes (680 Gm.) [1 lb. av., 7 ozs., 431 grs.]. Mix them. Keep the product in dark, amber-colored, glass-stoppered bottles. Diluted nitric acid contains 10 per cent, by weight, of absolute nitric acid. Specific gravity, about 1.057 at 15° C. (59° F.). It corresponds in properties to nitric acid (see *Acidum Nitricum*), and should conform to the same reactions and tests. To neutralize 6.29 Gm. of diluted nitric acid should require 10 Cc. of normal potassium hydrate V.S. (each cubic centimeter corresponding to 1 per cent of absolute acid), phenolphtalein being used as indicator"—(*U. S. P.*).

V. FUMING NITRIC ACID, *Acidum nitricum fumans*, *Nitroso-nitric acid*, *Acidum nitroso-nitricum.*—This acid, which is produced when a less amount of sulphuric acid and greater heat is employed than is required for the production of nitric acid, is a mixture of HNO_3 with varying amounts of the lower oxides of nitrogen. It is a brownish-red fluid, giving off suffocating, brown-red fumes. It has a specific gravity ranging from 1.45 to 1.50. In attempting to remove the stopper from the container great care should be observed that a portion of the acid is not forcibly expelled with the fumes. It should always be kept in a cool situation. A preparation, known as *commercial nitrous acid* is a weaker, though similar, acid, being colored red by nitrogen tetroxide in varying amounts, and consisting largely of nitric acid.

Action and Toxicology.—Nitric acid internally in medicinal doses long-continued, or in nitric-acid baths, may produce the following symptoms: Increased appetite at first and diuresis; white-coated tongue; mouth at first dry, and afterward abundantly bathed in saliva, with loosened and aching teeth, and spongy and bleeding gums; the dental enamel may be corroded. Foul breath, feverishness, headache, dyspepsia, intestinal colic, general debility, and bowel disorders, particularly constipation, may follow. The fumes inhaled are fatal, producing congestion, hemorrhage, and œdema of the breathing passages, with dyspnœa as the chief symptom. Mr. Haywood (1854), an English chemist, lost his life in this manner from the breaking of a carboy containing nitric and sulphuric acids. He died in eleven hours. Two firemen (1890) lost their lives from inhaling the nitrous fumes from a broken container of the acid during a fire. The fumes from batteries charged with the acid may poison in poorly-ventilated rooms. When swallowed, without dilution, nitric acid proves fatal; the same means may be employed to counteract its effects, as named for hydrochloric acid. The smallest amount which has produced death is 2 drachms, death occurring in 36 hours. Infants might be killed by a few drops, provided it came in contact with the larynx. The most rapidly occurring case of death took place in the usual manner in 1¾ hours; the slowest case died from exhaustion in eight months after its ingestion. Death usually results inside of 24 hours. (See Taylor, *Med. Juris.*). Fatal doses are immediately followed by intense, burning pain in throat and œsophagus, reaching to the stomach; gaseous eructations, abdominal swelling; violent emesis of fluids and solids, mixed with strongly acid, yellowish shreds of mucus, and dark-brown, altered blood. Great tenderness of the abdomen is felt. The oral membranes are soft and white, turning to yellow or brown. The teeth are also white or yellowish, and the dental enamel corroded. Viscid mucus fills the mouth, and swallowing or speaking is extremely difficult. The tongue is swollen and yellow, and the tonsils enlarged. Obstinate constipation ensues, and liquids increase the pain and vomiting. The pulse becomes quick, small, and irregular, the surface cold, and shivering takes place. A light stupor, from which the sufferer may easily be aroused, supervenes, and as a rule the intellect is unimpaired to the last. Should the fumes have been inhaled also, pneumonia complicates the case. After death the parts with which the acid came in contact exhibit shades varying from white to yellow and brown. The throat and trachea and lungs are congested and inflamed. The œsophageal membrane is yellow or brown, soft, and readily detachable in long shreds. The stomach shows the greatest damage, and though so soft as to break down under the faintest pressure, singularly no cases of perforation have yet been observed. The gastric membrane is partially inflamed, and exhibits patches of a yellow, brown, green, or black color. Such changes may be observed also in the duodenum, though only redness may be apparent.

Medical Uses and Dosage.—As an internal remedy nitric acid has a wide application. Discrimination, however, must be exercised in its use. The conditions under which it exhibits its selective action have been thus pointed out by Prof. Scudder: "If the tongue, whether pale, rose-red, or deep-red, presents a violet haze, we have an indication for nitric acid. We will notice the same violet haze wherever the blood comes to the surface in the capillary circulation. I think we get the most decided results when the mucous membranes are moderately red. Do not mistake the deep, solid purple of the mucous membranes we see sometimes for this violet haze, for here the irritable stomach very frequently presents the red tip and edges of tongue, and sometimes elongated papillæ"—(*Spec. Med.*, p. 189). Bearing out these indications, it has been very successfully used in *pneumonia*, *continued* and *typhoid fevers*, *typhoid dysentery*, and *malarial headache*. In *chronic ague* it has equalled cinchona in proper cases. Quinine sulphate dissolved in a few drops of nitric acid and diluted with water forms an excellent combination in some *malarial disorders*. In *stomach troubles* with irritability and enfeebled action it often benefits. Impaired nutrition, with slow and imperfect breaking down of effete matter and failure of excretion, often indicate nitric acid. Nitric acid has long been regarded refrigerant, expectorant, and antisyphilitic. A refreshing acidulous draught is formed by making a very dilute, sweetened, solution of nitric acid, which is useful in *fevers*, especially when there is a disposition to prostration or putrescency; it has likewise been recommended in *hepatic* and *syphilitic affections*. Dr. Gibbs recommended the following mixture as very valuable in *whooping-cough*: Take of diluted nitric acid, 12 fluid drachms; compound tincture of cardamon, 3 fluid drachms; simple syrup, 3½ fluid ounces; water, 1 fluid ounce. Mix. For a child one or two years old, a teaspoonful may be given every hour or two, washing the mouth out immediately after with some alkaline solution to prevent the teeth from being injured. That it is a positive remedy for some cases of *whooping-cough* is well attested by many practitioners. The indications will lead to the proper cases. Undoubtedly its radical, combined with sanguinarine, forming the nitrate, plays an important part in controlling *explosive coughs* having their origin in some derangement of the medulla. A severe case of this kind of two years' standing, and for the relief of which the patient had taken a trip to Oregon and remained awhile, was promptly cured by one prescription, as follows: R Nitric acid, gtt. x; sanguinarine nitrate, gr. j; specific drosera, gtt. x; water, fl℥iv. Mix. Sig.: A teaspoonful every 2 hours. Hope's mixture for *diarrhœa* and *dysentery* is composed as follows: Nitrous acid (or *double aqua fortis*), half a fluid drachm; camphor water, 4 fluid ounces; mix, and add laudanum. 40 ♏. The dose is a tablespoonful every 2 hours. Ten or 20 drops of the acid added to a pint of water forms a useful wash for sloughing and other ill-conditioned *ulcers*, and in various *chronic eruptions*, *porrigo of the scalp*, etc. Concentrated nitric acid has been used externally for several purposes, as the destruction of *warts*, cauterization of *poisoned wounds*, *stings*, *bites*, and in *phagedenic ulcerations*, in which the acid should be brought in contact with the living surface. I have also found it very useful in removing *pterygium*, and *ulceration of the os uteri*, *fistula in ano*, *syphilitic ulceration of the throat*, etc., applied daily, or every 2 or 3 days, by means of a pine wood portecaustic, first introduced to the profession by Prof. A. J. Howe, M. D.

In the treatment of *piles*, nitric acid is said to be very efficacious; the small tumors may be destroyed by a single application of it, while the larger may require two or three applications. If the tumors can not be extruded from the anus, a speculum must be used. The acid may be applied by a bit of sponge not larger than a grain of wheat, attached to a gold or glass probe. The severe pain which usually follows may be relieved by morphine, exhibited internally, and lard, or opiate suppositories applied locally. If too much acid has been applied, extending to contiguous parts, and causing unnecessary pain, it may be neutralized by applying a piece of sponge or cotton saturated with soda or potassa. Some claim greater certainty for this method than by excision or ligation.

For several years past I have used nitric acid as a local application to *chancre*. It must be applied while the chancre is in the pustular form and unbroken, and before the virus is acted upon by the oxygen of the atmosphere, and consequently previous to its absorption into the system. As soon as the pustule is discovered, the physician will open it and apply several drops of undiluted nitric acid to it, thus destroying the virus at once and curing the disease in a few minutes. The pain occasioned is hardly noticed by some patients. Sometimes, I subsequently wash the ulcer with the tincture of chloride of iron, which is one of the best local applications to a chancre. No other treatment is required, unless for the purpose of allaying the patient's fears. Since having introduced this employment of the acid to the profession, many have employed it, and with uniformly successful results (J. King). The improbable claim of curing *albuminuria* and "*Bright's disease*" (an uncertain complaint) with daily diluted injections of this acid per rectum is made by a Rochester, N. Y., physician. Upon the skin this acid is said to resemble thuja in its power over *condylomata*, *anal fissure*, and *sores* about the body outlets. Ringer declares that "small syphilitic warts and condylomata are painlessly and surely dispersed by the constant application of a dilute wash (1 or 2 drachms of diluted nitric acid to 1 pint of water)." Nitric acid applied with a broom-splint may be used to destroy large *granulations* and *polypi* in the tympanic cavity (Foltz). Nitric acid is never given internally unless very much diluted. Its dose is from 1 to 20 (strong acid) or 1 to 50 (diluted acid) drops in 4 or 6 fluid ounces of water; it should be sucked through a quill or glass-tube, to prevent its injuring the teeth, and the mouth should be rinsed with an alkaline solution immediately after each dose. For its specific use Prof. Scudder directs: ℞ Nitric acid, gtt. xxx; simple syrup, fl℥ iv. Mix. Dose, a teaspoonful every 3 hours.

Specific Indications and Uses.—The pale, rose-red, or deep-red tongue, with a violet haze, seemingly like a transparent color over red; usually with moderately red membranes (Scudder); harsh, explosive cough of medullary origin; cases of imperfect waste with foregoing indications.

Liquid Glue.—When nitric acid is added to a solution of glue it prevents it from forming a jelly, and makes what is called a liquid glue, which is very convenient for cabinet-makers, joiners, paste-board workers, toy-makers, etc., inasmuch as it is applied cold. The liquid glue is made by taking 2½ pounds of good glue, and dissolving it in 2½ pints of water, in a glazed pot over a gentle fire, or, still better, in the water-bath, stirring it from time to time. When all the glue is melted, pour in, in small quantities at a time, of nitric acid specific gravity 1.32, 7 ounces avoirdupois. This addition produces an effervescence, owing to the disengagement of hyponitrous acid. When all the acid is added, remove the vessel from the fire, and allow it to cool. This preparation preserves nearly all the primitive qualities of the glue, may be kept in an open vessel for years, without undergoing any change, and will be found very convenient in chemical operations; gases may be preserved by it by covering strips of linen with it.

ACIDUM NITROHYDROCHLORICUM (U. S. P.)
—NITROHYDROCHLORIC ACID.

SYNONYMS: *Nitromuriatic acid*, *Acidum nitromuriaticum*, *Acidum chloronitrosum*, *Aqua regia*, *Aqua regis*.

Preparation.—"Nitric acid one hundred and eighty cubic centimeters (180 Cc.) [6 fl℥, 42 ♏]; hydrochloric acid, eight hundred and twenty cubic centimeters (820 Cc.) [27 fl℥, 349 ♏]. Mix the acids in a capacious glass vessel, and, when effervescence has ceased, pour the product into dark, amber-colored, glass-stoppered bottles, which should not be more than half filled, and keep them in a cool place"—(*U. S. P.*).

Description.—"A golden-yellow, fuming, and very corrosive liquid, having a strong odor of chlorine. Completely volatilized by heat. It readily dissolves gold-leaf, and a drop of it added to potassium iodide T.S., liberates iodine"—(*U. S. P.*). This mixture should be made in the open air to allow the disagreeable fumes to pass off. It should be kept in a dark-colored, glass-stoppered bottle, and the patient directed to keep it away from fires and light. On account of the property possessed by this mixture of dissolving platinum and gold—the noble metals—it was named "*aqua regia*" or "*royal water*." Heat causes it to lose its chlorine, while light may convert its chlorine into chlorhydric acid. It should not be made in great quantities on account of its proneness to decomposition if long kept in stock; nor should it be prepared extemporaneously, for sufficient time must elapse for the reaction to cease, and on no account must it be put in bottles and stoppered before effervescence has subsided. It contains free chlorine and several chlorinated products, among them *nitrosylchloride* (NOCl, chloronitrous acid), a yellow-red liquid, decomposed by water into nitrous and hydrochloric acids. Nitrosylchloride has a low boiling point —5° C. (23° F.).

Action, Medical Uses, and Dosage.—Large quantities of this acid act as a corrosive poison like its constituents, and in poisoning by it like treatment should be instituted. Even small doses attack the dental enamel and gold fillings and produce gastric derangements. When used diluted as a bath, it is absorbed, increasing the hepatic and renal secretions, and producing a sense of burning in the mouth and fauces, and induces profuse ptyalism, redness and tumefaction of the gums, and buccal ulcers. Diarrhœa is occasioned by it also. It was introduced as a remedy for *hepatic affections*, the bath being preferred, but it is not now much employed in this manner. Small doses of this or the diluted acid are sometimes employed in *hepatic calculi*, hepatic fulness and tenderness, *dyspepsia* with constipation or slight *jaundice*, *oxaluria*, *scrofula*, *syphilis*, and *skin diseases*, but it probably possesses no advantages over its constituents, and is more likely to disorder the stomach and bowels. Bathing with a dilute solution of this acid, say 1 part of acid to 6 of water, is asserted to have cured several cases of obstinate constipation. Some prefer the stronger to the diluted acid. A preparation which was once highly lauded for the cure of *corns*, *warts*, *cancers*, etc., Dr. Bleeker's remedy, is said to be a compound of nitrohydrochloric acid and cobalt. Dose of nitrohydrochloric acid, 1 to 5 drops, highly diluted, after meals, and followed by an alkaline wash to protect the teeth.

WHITE LIQUID PHYSIC.—A preparation has been highly recommended, called *White Liquid Physic*, or *Dow's Physic*. It is made as follows: Take sulphate of sodium ½ pound, water 1½ pints; dissolve, and then add nitrohydrochloric acid 2 fl℥, powdered alum 68 grains. This preparation is used as a cooling purgative; also to allay nausea and vomiting—for *colic*, *hepatic diseases*, *oxaluria*, *diarrhœa*, etc. Given by some as a substitute for mercury. In *intermittent fever*, given in laxative doses, it has proved highly beneficial, especially when occurring in broken-down constitutions, and has cured the most obstinate cases of *dysentery*. Dose, 1 tablespoonful in a gill of water 3 times a day; or, in dysentery, given every hour, until it slightly operates the bowels, after which, every 3 or 4 hours. In order to protect the teeth from the action of the acid, in this preparation, each dose should be sucked through a straw, reed, or glass tube; and, immediately after the dose has been swallowed, the mouth should be rinsed once or twice with an alkaline solution. The above is the original recipe, and the addition of sanguinaria, etc., are uncalled for.

The White Liquid Physic as given by Dr. Scudder (*Mat. Med.*, p. 185), is made as follows: ℞ Sulphate of sodium lb.ss; water Ojss; dissolve the sulphate of sodium in the water, and add nitric acid ℥j; hydrochloric acid ℥j. This he regarded as one of the most efficient remedies in *dysentery*, used to produce at least one bilious evacuation, and afterwards continued in smaller doses. "It acts directly upon the liver, removes the constipated state of the upper part of intestinal canal, lessens the tormina and tenesmus, and speedily checks the dysenteric discharge" (Scudder). Dose, a tablespoonful every hour in sweetened water until catharsis ensues.

ACIDUM NITROHYDROCHLORICUM DILUTUM (U. S. P.)—DILUTED NITROHYDROCHLORIC ACID.

SYNONYMS: *Diluted nitromuriatic acid, Acidum nitromuriaticum dilutum.*

Preparation.—"Nitric acid forty cubic centimeters (40 Cc.) [1 fl℥, 169 ♏]; hydrochloric acid one hundred and eighty cubic centimeters (180 Cc.) [6 fl℥, 42 ♏]; distilled water seven hundred and eighty cubic centimeters (780 Cc.) (26 fl℥, 180 ♏]. Mix the acids in a capacious glass vessel, and, when effervescence has ceased, add the distilled water. Keep the product in dark, amber-colored, glass-stoppered bottles, in a cool place"—(*U. S. P.*).

Description.—"A colorless, or pale-yellowish liquid, having a faint odor of chlorine, and a very acid taste. Completely volatilized by heat. From potassium iodide T.S. it liberates iodine"—(*U. S. P.*). In this product it is now accepted that the nitrosyl chloride of nitrohydrochloric acid is decomposed, through the presence of water, into hydrochloric acid and nitrogen trioxide, which forms a solution of nitrous acid. Like nitrohydrochloric acid, it contains free chlorine, thus necessitating that it be kept cool in a dark situation.

Medical Uses and Dosage.—Uses same as for nitrohydrochloric acid. Dose, 5 to 25 minims largely diluted with water, repeated 2 or 3 times a day, and followed by an alkaline wash to protect the teeth.

ACIDUM OLEICUM (U. S. P.)—OLEIC ACID.

FORMULA: $HC_{18}H_{33}O_2$. MOLECULAR WEIGHT: 281.38.

SYNONYM: *Elaic acid.*

"An organic acid, prepared in a sufficiently pure condition by cooling commercial oleic acid to about 5° C. (41° F.), then separating and preserving the liquid portion"—(*U. S. P.*).

Source and Preparation.—This acid was first obtained by Chevreul in 1821. It is a constituent of most fats, and of the non-drying fixed oils in the form of glycerin trioleate (triolein). It is obtained in large quantities as a by-product in the manufacture of candles. In this condition it is very impure, of a dark, reddish-yellow or brownish-red color (*red oil*), and at ordinary temperatures somewhat turbid. An early method of obtaining this acid was as follows: To procure *oleic acid*, treat oil of bitter almonds with caustic potash, and to the soap formed add hydrochloric acid; this separates the oleic and other acids. To the decomposed mixture add about half its weight of oxide of lead, and digest for 2 or 3 hours at a temperature of 100° C. (212° F.), by which means oleates of the fatty acids are formed. Ether is now added, which dissolves only the oleate of lead; the ethereal solution is mixed with an equal volume of water, to which hydrochloric acid is added as long as is required for decomposition, and the mixture is then well shaken. The ether rises to the surface, holding the oleic acid in solution; decant it and distill it off; there remains a compound of pure oleic acid with oxidized acid. By subjecting this compound to a temperature of about —7.2° C. (19° F.), the pure crystals of oleic acid form, while the oxidized acid remains in solution. Wolff recommends the substitution of petroleum benzin in the place of ether. The method of Chas. T. George (*A. J. P.*, 1881) is to dissolve dry, white castile soap (30 parts) in hot water (100 parts) and then to decompose the solution with sulphuric acid (6 parts). After washing the resulting oily layer with warm water, powdered litharge (2 parts) is added to it, and the lead oleate formed is dissolved, while warm, in petroleum benzin (10 parts). This solution is decomposed with weak hydrochloric acid (1 part with 12 of water). Evaporate the benzin, and oleic acid (15 parts) remains.

Description and Tests.—Oleic acid is a tasteless, inodorous, colorless, oily fluid at temperatures above 13.8° C. (57° F.), but when once melted it does not solidify until cooled to 4.4° C. (40° F.), and when solid it does not melt until heated to 13.8° C. (57° F.) It is not soluble in water, but readily soluble in alcohol or ether, floats on water, and becomes brown by the absorption of atmospheric oxygen, with which it has a tendency to combine. It forms salts or soaps with bases. The oleic acid, as it occurs in non-drying fat oils, like olive oil, is chemically different from that occurring in drying oils, the type of which is linseed oil. Oleic acid, when in contact with nitrous acid, is converted into an isomeric solid compound called *elaïdic acid*.

Oleic acid is not decomposed when distilled *in vacuo*, but if heated in the air it decomposes, forming hydrocarbons, *sebacic acid*, and volatile fatty acids. When treated with fused caustic potash, decomposition takes place, with acetic and palmitic acids as a result. With sodium and potassium hydroxides it forms soaps known respectively as *oleate of sodium* and *oleate of potassium*, classed among *hard* and *soft soaps*. This acid is used in the preparation of the oleates, a class of external applications now used in considerable quantities. The *United States Pharmacopœia* describes, as follows, the oleic acid that should be employed in pharmacy: "A yellowish or brownish-yellow, oily liquid, having a peculiar lard-like odor and taste; becoming darker and absorbing oxygen on exposure to air. Specific gravity about 0.900 at 15° C. (59° F.). Insoluble in water; soluble in alcohol, chloroform, benzol, benzin, oil of turpentine, and fixed and volatile oils. When cooled to about 4° C. (39.2° F.), oleic acid becomes semi-solid, and, on further cooling, congeals to a whitish, solid mass. When heated to a temperature of about 95° C. (203° F.), the acid begins to be decomposed, giving off acrid vapors. At a higher temperature it is completely dissipated. An alcoholic solution of oleic acid has a feebly acid reaction upon litmus paper. Equal volumes of oleic acid and alcohol, mixed at the ordinary temperature, should give a clear solution without separating any oily drops upon the surface (absence of fixed oils). If 1 Gm. of oleic acid be heated with 20 Cc. of alcohol, 2 drops of phenolphtalein T.S. added, and then a strong solution (1 in 4) of sodium hydrate, drop by drop, until the liquid has acquired a permanent red tint and the acid is saponified; next acetic acid added until the red color of the liquid is just discharged, and the liquid filtered—10 Cc. of the filtrate mixed with 10 Cc. of ether should not be rendered more than slightly turbid by the addition of 1 Cc. of lead acetate T.S. (absence of notable quantities of palmitic and stearic acids)"—(*U. S. P.*).

Linoleic acid is used to adulterate oleic acid. It may be detected with potassium permanganate, which converts oleic acid into *azaleinic acid*, and *linoleic acid* into *sativic acid*. The latter does not dissolve in ether while the former does. As little as 1 per cent of this impurity may be detected by this salt (*A. P. A. Proceed.*, 1890). Linoleic and ricinoleic acids constitute the fatty acids occuring in the drying oils.

Use.—Used only in preparing the *oleates*.

Related Products.—SULPHO-OLEIC ACID. *Sulpholeic acid* ($C_{17}H_{22}CO_2HSO_3H$). This acid is formed when sulphuric acid reacts upon castor, olive, almond, or other fixed oils, provided the temperature be not higher than 50° C. (122° F.). To obtain the acid in an anhydrous state ether is employed to remove the oil not acted upon, and the crude product is treated with alkaline carbonates or hydroxides, treated again with sulphuric acid, and finally evaporated in pure condition from benzin, or from ether. The substances known as *oleite*, *polysolve* and *solvine*, are neutral salts of this acid from its combination with alkaline bases. Water dissolves these salts (sulpholeates) and they in turn may be employed to render many otherwise insoluble substances miscible with water. *Sulphoricinoleic acid* is the name applied to that prepared with castor oil. The sulpholeates mix with many organic substances.

SULPHORICINIC ACID. Prepared by acting upon castor oil at a heat not higher than 50° C. (122° F.) with from 30 to 40 per cent sulphuric acid. Upon adding water, the sulphoricinic acid together with some free oil, separates as an oily stratum, an aqueous acid solution underlying. It is an active topical irritant. It, as well as its soluble salts are decided deodorizers and antiseptics. They have been used in ozena and like conditions. Salol sulphoricinate, creosote sulphoricinate, and naphthol sulphoricinate, have been employed as local medicines. *Phenolum natrio sulphoricinicum* is a yellowish liquid containing sodium sulphoricinate (80 per cent) and phenol (20 per cent). It is miscible in all proportions with water. A 20 per cent solution has been recommended as a topical application in *diphtheria*. *Skin and mucous-surface affections*, tubercular and otherwise, have been treated with it.

OLEITE (*Sodium sulphoricinoleate*) is a scarcely odorous, transparent, gelatinous fluid, soluble in water, alcohol, volatile oils, and chloroform. Its taste is acrid. It has extraordinary solvent powers upon many substances employed in medicine. It is non-poisonous internally or externally, and being soothing, is recommended as an ointment base. It is said to act kindly in *cuts*, *scalds*, *burns*, etc.

ACIDUM OXALICUM.—OXALIC ACID.

FORMULA: $H_2C_2O_4.2H_2O$. MOLECULAR WEIGHT: 125.7.

History.—Oxalic acid was discovered by Scheele, in 1776, and it is found in the organic as well as in the inorganic kingdoms. In plants it is generally met in combination with calcium or potassium; rhubarb, Rumex acetosa, Oxalis acetosella, phytolacca, belladonna, etc., contain the acid or bin-oxalate of potassium; rhubarb also contains oxalate of calcium, as likewise do many lichens, and in the human body it forms the mulberry calculus, a frequent form of gravel. In combination with calcium it is found in ginger, orris-root, squill, valerian, curcuma, quassia, and other drugs. As an ammonium oxalate it is present in the fertilizer *guano*. In the *Cicer arietinum* or *chick pea* it occurs in a free condition. It may also be formed artificially by the action of nitric acid on sugar, molasses, rice, starch, gum, wool, silk, hair, and many other organic compounds, which are free from nitrogen. Berthelot has obtained it synthetically from acetylene, ethylene, propylene, and allylene, by oxidation with permanganate of potassium.

Preparation.—There are several methods by which oxalic acid may be procured; the following are considered among the best:

1. Gently heat 1 part of pure starch with 8 parts of nitric acid of sp. gr. 1.200 or 1.250. A powerful reaction ensues, with an evolution of red nitrous acid vapors; when this diminishes, heat must be applied, and continued until no more red vapors are given off; if sufficiently evaporated, a large quantity of crystals of hydrated oxalic acid are deposited as the liquid cools. These are dried on a porous tile, then dissolved in a little hot water, and pure oxalic acid is deposited as the solution cools. The mother liquor remaining after the first deposit of crystals contains much free nitric acid, saccharic acid, and other products.

2. Digest 1 pint of sugar dried at 100° C. (212° F.) with 8.25 pints of nitric acid of sp. gr. 1.380. Evaporate the mixture to a sixth, and leave to crystallize. This process requires but an hour or two, and yields from 50 to 60 per cent of handsome crystals.

3. An ingenious and economical method of manufacturing oxalic acid from sawdust has been devised by Mr. Dale, of England. It is as follows: two equivalents of caustic soda and one equivalent of caustic potash are mixed together, dissolved in water, and the solution evaporated until it has a sp. gr. 1.350, when enough sawdust is to be stirred in to form a thick paste. This paste is heated on iron plates, being constantly stirred. At first, water escapes; the mass then swells; inflammable gases, hydrogen, and hydrocarbons are evolved, along with a peculiar aromatic odor. When the temperature has been maintained at 204.4° C. (400° F.) for an hour or two, this stage of the process is complete. The mass has a dark color, contains from 1 to 4 per cent of oxalic acid, and about 0.5 per cent of formic acid; the balance of the mass consists of an unknown substance, which is intermediate between cellulose and oxalic acid. The next stage consists in heating the mass till quite dry, being careful that no charring takes place; a gray powder is formed, containing from 28 to 30 per cent of oxalic acid, in combination with sodium and potassium. The gray powder is now washed on a filter with a solution of carbonate of sodium, which decomposes the oxalate of potassium, and converts it into oxalate of sodium, which is decomposed by boiling milk of lime, oxalate of calcium being precipitated while the sodium hydroxide remains in solution. The oxalate of calcium being placed in leaden vessels, is treated with sulphuric acid, which precipitates the calcium and leaves the oxalic acid in solution, which may be obtained in crystals by evaporation. The sodium hydroxide left in solution after the addition of milk of lime, may be recovered by boiling, and be again made use of with fresh sawdust. The same may be done with the potassium salt which filters through in the last stage. By this process 2 pounds of sawdust are made to yield 1 pound of oxalic acid.

Description.—Oxalic acid crystallizes in colorless, transparent, oblique, quadrilateral prisms with two-sided summits. The crystals are inodorous, have a strongly acid taste, faintly effloresce in a dry atmosphere, redden litmus paper. and when pure are completely volatilized by heat, and without becoming blackened. They dissolve in from 8 to 11 parts of water at 15.5° C. (60° F.), in their own weight of water at 100° C. (212° F.), and in 4 parts of alcohol; the addition of a small quantity of nitric acid to the water causes them to dissolve more readily. Nearly all the oxalates are insoluble in water, excepting the alkaline. Oxalate of calcium is insoluble, and hence oxalic acid is useful as a test for calcium, and is usually employed in the form of oxalate of ammonium; if the liquor to be examined contains any free acid, this must first be neutralized, as the oxalate can only detect calcium in neutral or alkaline fluids. Oxalic acid reduced by hydrogen is converted into glycolic and acetic acids, and if the action be kept up sufficiently long the glycolic becomes wholly formed into acetic acid.

Oxalic acid may be detected in any solution, by being entirely volatilized by heat; by yielding a white precipitate with nitrate of silver, soluble in nitric acid; and by giving a white precipitate with lime water, which is insoluble in water, readily soluble in nitric acid, insoluble in acetic acid, and which, when dried and heated to low redness, is converted, without blackening, into carbonate of calcium. Solution of sulphate of calcium produces a bluish-white precipitate with oxalic acid. Oxalic acid is sometimes contaminated with nitric acid, which gives a faint odor to it, and stains the cork of the bottle in which it is kept, yellow. If a very dilute solution of sulphate of indigo, containing the impure crystals, be boiled, the nitric acid present will decolorize the solution. On account of the resemblance between crystals of this acid and of magnesium sulphate, the latter has been used as an adulterant. This resemblance has also led to cases of poisoning, the person believing the acid to be Epsom salts. The acid may likewise be used for removing iron-rust and ink-stains from linen, and is employed in calico printing as a bleaching and discharge agent.

SALT OF SORREL, *Salt of lemon*, or *Essential salts of lemon* (acid or binoxalate of potassium), is well known to the laity as an agent to remove iron-stains, though oxalic acid is generally used now, and is often sold under these popular names.

Action and Toxicology.—Oxalic acid and the oxalates poison the nervous system and the blood, producing, as well, gastro-intestinal lesions. A dose of 60 grains killed a boy (Taylor). Again, by prompt treatment, two cases recovered after a half ounce had been swallowed. Death takes place in varying lengths of time, a circumstance that can not readily be accounted for. Some cases die in from 10 minutes to an hour. The above-mentioned boy died in 8 hours. The symptoms are an intensely pure, acid taste, burning of the parts over which the poison passes, intense pain, vomiting, especially a bloody material, an extremely feeble pulse, an inability to assume the upright posture, collapse, and stupor. These symptoms, with the rapidity with which death takes place, will point to oxalic acid as the cause. Still, persons have been known to live for 22 days, death being produced by a slow poisoning. The post-mortem changes are a whitened œsophageo-gastric tract, though the stomach may contain a dark, gelatinous liquid, appearing like disorganized blood. The mucous coats are softened and loosened, but rarely perforated. The blood is excessively red, and in some instances oxalates have been found in the *tubuli uriniferi* of the kidneys. Koch regards it as a heart poison. The same lethal symptoms may be produced from salt of sorrel. Poisoning by oxalic acid, oxalate of ammonium, or oxalate of potassium, is best remedied by the speedy administration of chalk, suspended in water; when chalk can not be had, magnesia may be used; either of these forms insoluble oxalates.

Medical Uses and Dosage.—This article, unless in great attenuation, is an unfit agent for internal administration, though it has been given in doses of three-quarters of a grain every 3 hours in *diphtheria*. Such a procedure is certainly dangerous, and an infusion of sorrel, sumac-bobs, and similar substances containing the acid in combination, would even be hazardous. These infusions have, however, given excellent results in *diphtheria* and certain *sore throats* when used simply as a gargle. Webster (*Dynamical Therapeutics*, 175), praises the action of oxalic acid in lagging functions of the spinal cord due to over-exertion, thereby resulting in tensive pains, marked lumbar weakness, and insomnia. One or two grains of the 6x trituration every 4 or 5 hours, are recommended in these conditions. A solution of oxalic acid in water promptly removes iron stains. For a number of years past I have used a saturated aqueous solution of it as an external application in *cutaneous cancer*, *acne*, *scald head*, and several forms of cutaneous disease, since which, on my recommendation, others have employed it with success in similar affections, sometimes alone, and again with a small portion of creosote added. The saturated solution, neutralized by caustic potash, forms an excellent application to discuss *indolent tumors* (J. King).

ACIDUM PHOSPHORICUM (U. S. P.)—PHOSPHORIC ACID.

FORMULA: H_3PO_4. MOLECULAR WEIGHT: 97.8.
ACIDUM PHOSPHORICUM (*U. S. P.*), *Phosphoric acid*, *Orthophosphoric acid*.
ACIDUM PHOSPHORICUM GLACIALE, *Glacial phosphoric acid*, $HPO_3 = 80$
ACIDUM PHOSPHORICUM DILUTUM (*U. S. P.*), *Diluted phosphoric acid*.

The official phosphoric acid should contain not less than 85 per cent of absolute orthophosphoric acid, and the diluted phosphoric acid 10 per cent, both by weight.

Source and Modifications.—When dry phosphorus is burned in the air or in the presence of dry oxygen, a white body, having the form of snow-like flakes, and the composition P_2O_5, is produced. This is phosphoric anhydride (metaphosphoric anhydride, phosphorus pentoxide, or phosphoric oxide), and being very hygroscopic it unites with moisture with great avidity, becoming converted into a monobasic acid (HPO_3)—*glacial phosphoric acid* or *monobasic metaphosphoric acid*. A second modification of P_2O_5, is the commonly employed phosphoric acid or *normal* or *orthophosphoric acid* (H_3PO_4). Glacial phosphoric acid dissolved in water, and nitric acid added to the solution until red fumes cease to be evolved (*U. S. P.*, 1870), will produce the orthophosphoric acid. The official acid is not now made in this manner, however, and, in fact, should not be so prepared on account of the impurities in commercial glacial phosphoric acid, but is produced from bone ash, which is principally a tricalcium phosphate (a salt of tribasic orthophosphoric acid). A third modification is that produced by carefully heating crystallized orthophosphoric acid to a temperature of 213° C. (415.4° F.), when 1 molecule of water is dispelled from 2 molecules of the acid, thus: $2H_3PO_4 - H_2O = H_4P_2O_7$.. This product is *pyrophosphoric acid* (the bibasic diphosphoric acid). It is a sour, colorless, inodorless acid, and gives rise to the pyrophosphates.

Preparation.—I. ACIDUM PHOSPHORICUM, *Phosphoric acid*.—C. L. Diehl, Jr., recommends the following modification of the London process as a perfectly safe one: Into a French glass tubulated retort of 42 parts capacity introduce 12 parts of distilled water and 2 parts of phosphorus. Place the retort on a sand-bath and introduce through a funnel tube, fixed in the tubulure by means of a cork and reaching half an inch below the level of the liquid, 8 parts of nitric acid. Apply gentle heat, and watch the operation closely as soon as reaction commences. When the reaction slackens, add more nitric acid in portions of about one-fourth at a time. Should the reaction become violent, small quantities of warm water must be added until it is reduced to its ordinary action, which may be compared to the gentle boiling of water. The formation of frothy bubbles on the surface of the liquid is always the forerunner of violent reaction, and should be checked at once. I have found that if checked at this stage, a comparatively small amount of water would answer, but if allowed to react violently a much larger quantity of water will be required. After the phosphorus is all oxidized evaporate the acid in a porcelain capsule. As owing to the rapid disengagement of nitric oxide the liquid will froth up toward the termination of the process of evaporation, the capsule should have about three times the capacity of the acid when concentrated, and a little distilled water should be kept conveniently near, to add in case there is danger of frothing over. The operation should be conducted under a good furnace-hood, or else the beak of the retort should be introduced into a good flue, to carry off the vapors—*Amer. Jour. Pharm.*, 1867, p. 138).

II. ACIDUM PHOSPHORICUM GLACIALE, *Glacial phosphoric acid*.—Sulphuric acid and white-burned bones, of each, 1 part; water, 15 parts. Add the water to the acid and the bones to the solution, and digest until a smooth white paste of calcium sulphate is produced from the insoluble portion of the bones. Filter and wash with water; and to the filtrate, which contains phosphoric and sulphuric acids and solution of phosphates of calcium and magnesium, add aqua ammoniæ or ammonium carbonate to neutralization. Finally, filter again to separate the precipitate of phosphates and evaporate. Completely drive off the ammonia from the phosphate of ammonium by heating the latter in a platinum crucible. Pour the melted acid on smooth iron surfaces, cool, and transfer the glassy masses to closely-stoppered bottles.

This acid may also be obtained by heating mono-sodium phosphate to redness, which expels one molecule of water; the fused mass is then dissolved in water, and precipitated by acetate of lead. The lead precipitate is treated with sulphide of hydrogen, which decomposes the lead salt, forming a sulphide of lead, and leaving the acid free in the solution. Its dilute solution may be kept without change, but boiling converts it into ordinary phosphoric acid. The chemistry of the modifications of phosphoric acid was first definitely established by Thomas Graham in 1833. Ordinary phosphoric acid was discovered in tri-calcium phosphate by Gahn in 1769, but was not isolated until Scheele obtained it in 1771.

The solutions of the foregoing modifications present the following differences in reaction:

	With albumen.	With calcium chloride.	With barium chloride.	With argentic nitrate
METAPHOSPHORIC ACID, HPO_3 ($H_2P_2O_6$, Rother).	Coagulation	White precipitate.	White precipitate.	Gelatinous, transparent precipitate.
ORTHOPHOSPHORIC ACID, H_3PO_4 ($H_6P_2O_8$, Rother).	No effect...	No effect...	No effect...	*Yellow* precipitate if a small amount of aqua ammoniæ be added. *No* precipitate with silver nitrate alone.
PYROPHOSPHORIC ACID, $H_4P_2O_7$.	No effect...	No effect...	No effect...	*White* precipitate if a small amount of aqua ammoniæ be added. Its solution yields a precipitate with silver nitrate alone, which is insoluble in excess of the acid.

It will be observed that the three acids—metaphosphoric, pyrophosphoric, and orthophosphoric—are chemical combinations of phosphoric oxide (P_2O_5), with one, two, and three molecules of water respectively, thus:

Metaphosphoric acid $= P_2O_5 + H_2O = H_2P_2O_6$ ($2HPO_3$).
Pyrophosphoric acid $= P_2O_5 + 2H_2O = H_4P_2O_7$.
Orthophosphoric acid $= P_2O_5 + 3H_2O = H_6P_2O_8$ ($2H_3PO_4$).

III. ACIDUM PHOSPHORICUM DILUTUM (*U. S. P.*), *Diluted phosphoric acid.*—Take "phosphoric acid, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; distilled water, seven hundred and fifty grammes (750 Gm.) [1 lb. av., 10 ozs., 199 grs.]. To make eight hundred and fifty grammes (850 Gm.) [1 lb. av., 13 ozs., 430 grs.]. Mix them. Keep the product in well-stoppered bottles"—(*U. S. P.*).

Description.—I. ACIDUM PHOSPHORICUM (*U. S. P.*), *Phosphoric acid.*—"A liquid composed of not less than 85 per cent, by weight, of absolute orthophosphoric acid [$H_3PO_4 = 97.8$], and not more than 15 per cent of water. The above-mentioned percentage (85) is that assumed for phosphoric acid in the formulas of pharmacopœial preparations. Phosphoric acid should be kept in glass-stoppered bottles"—(*U. S. P.*). The Pharmacopœia directs: "A colorless liquid, without odor, but having a strongly acid taste. Specific gravity, not below 1.710 at 15° C. (59° F.). Miscible, in all proportions, with water or alcohol. When heated the liquid loses water; at 200° C. (392° F.) it gradually begins to change to pyrophosphoric acid. At a still higher temperature it is converted into metaphosphoric acid, which volatilizes in dense fumes, or forms, on cooling, a transparent mass of glacial phosphoric acid. The acid, even when largely diluted, has an intensely acid reaction upon litmus paper"—(*U. S. P.*). Although evaporated so as to become dense, this acid does not act upon animal and vegetable matter like sulphuric and other mineral acids.

II. Acidum Phosphoricum Dilutum (*U. S. P.*), *Diluted phosphoric acid.*—"Diluted phosphoric acid contains 10 per cent, by weight, of absolute orthophosphoric acid. Specific gravity, about 1.057 at 15° C. (59° F.). It corresponds in properties to phosphoric acid (see *Acidum Phosphoricum*), and should conform to the same reactions and tests. 4.89 Gm. of diluted phosphoric acid should require for neutralization 10 Cc. of normal potassium hydrate V.S. (each cubic centimeter corresponding to 1 per cent of the absolute acid), phenolphtalein being used as indicator"—(*U. S. P.*).

Microscopic vegetative growths may spring up in diluted phosphoric acid if the preparation be kept for too great a length of time. This change may be prevented by the presence of a mere trace of chlorhydric acid.

III. Acidum Phosphoricum Glaciale. *Glacial phosphoric acid.*—Pure glacial phosphoric acid is a soft mass, somewhat gummy in consistence, and requires the presence of some alkaline base, as sodium, to render it solid and glassy when cold. It requires a high temperature to fuse it, and volatilizes at a red heat. The commercial glacial phosphoric acid does not correspond to the former in its properties, and is apt to be a very impure product, large quantities of sodium phosphate and other salts having been found in samples of it. It is chiefly made in Germany. The acid of commerce is in reality a mixture of metaphosphoric and pyrophosphoric acids, the proportion varying according to the manner of making it, whether the heating has been prolonged or not, or whether or not too high a temperature is maintained. The commercial product occurs in glass-like masses, transparent and deliquescent, and its solution in both water and alcohol has an acid reaction and is strongly acid to the taste. Its aqueous solution gradually changes to ordinary phosphoric acid, a change which is accelerated by boiling, or by the presence of nitric acid. The time required for this conversion of a solution of 1 part acid to 2 parts of water is about 15 minutes (L. Thompson).

Tests.—The *Pharmacopœia of the United States* directs the following tests: "If a small portion of phosphoric acid be supersaturated with ammonia water, the addition of magnesium sulphate T.S. (or of magnesia mixture) produces a white, crystalline precipitate. If this precipitate be dissolved in diluted acetic acid, the solution yields a yellow precipitate with silver nitrate T.S. If a crystal of ferrous sulphate be dropped into a cooled mixture of 1 Cc. each of phosphoric and sulphuric acids, no brown or brownish-black color should appear around the crystal (absence of nitric acid). If 1 Cc. of phosphoric acid be diluted with 5 Cc. of water, and the liquid gently warmed, it should not be blackened upon the addition of a small amount of silver nitrate T.S., or rendered turbid by mercuric chloride T.S. (absence of phosphorous acid). If 1 Cc. of phosphoric acid (in which nitric and phosphorous acids have previously been shown to be absent) be mixed with 1 Cc. of stannous chloride T.S. (see *List of Reagents*, Bettendorff's Test for Arsenic), and a small piece of pure tin-foil added, no coloration should appear within 1 hour (limit of arsenic). Upon adding to 1 Cc. of phosphoric acid a mixture of 3 Cc. of alcohol and 1 Cc. of ether, no turbidity should appear (absence of phosphate). After neutralizing a portion of the acid with ammonia water, the addition of ammonium sulphide T.S. should produce neither a color nor a precipitate (absence of iron, etc.). After diluting a portion of the acid with 5 volumes of water, no precipitate should be produced, in separate portions of the liquid, by barium chloride T.S. (absence of sulphuric acid), or by silver nitrate T.S. (absence of hydrochloric acid); nor should any precipitate be formed, even after several hours, by the addition of an equal volume of tincture of ferric chloride (absence of pyrophosphoric and metaphosphoric acids). 0.978 Gm. of phosphoric acid, diluted with water, should require, for neutralization, not less than 17 Cc. of normal potassium hydrate V.S. (each cubic centimeter corresponding to 5 per cent of the absolute acid), phenolphtalein being used as indicator"—(*U. S. P.*). Another important test for phosphoric acid is that of molybdate of ammonium, made by dissolving molybdic acid in excess of ammonia, detecting even traces of it; when added in excess, it forms with this acid a bright yellow precipitate of ammonium phospho-molybdate of the composition

$2PO_4(NH_4)_3+22MoO_3+12H_2O$ (Rammelsberg). However, the composition seems to vary according to conditions. If diluted phosphoric acid be neutralized with ammonia, nitrate of silver occasions a yellow precipitate of phosphate of silver. Arsenous acid is the only acid similarly acted on; and it may be determined from phosphoric acid by the action of hydrogen sulphide, which causes a yellow precipitate with the arsenous acid, while it has no effect at all upon the phosphoric. Arsenic may also be detected by Marsh's test.

Action, Medical Uses, and Dosage.—This acid produces the usual effects of the diluted mineral acids, but is milder and more assimilable. In addition, a mild intoxication, not unlike that produced by alcohol, is produced by doses ranging from 40 to 180 minims. Larger doses produce a feeling of inertia and drowsiness, which persists for some little time. Locally, when concentrated, it is irritant and mildly escharotic. By improving the appetite and digestion, it favors nutrition and growth. It has been used to check *abnormal osseous secretions*, to remove *phosphatic urine*, to relieve *spasmodic affections*, and is frequently beneficial in the *nervous debility* of persons advanced in years, in the thirst accompanying *diabetes*, in *impotency*, or feebleness of the sexual functions, and in *fluor albus*. That form of *diabetes* induced by mental disturbances, and in broken-down, nervous individuals, is the kind benefited by it. *Functional deafness*, from inner ear disorders with atony of the nervous system, is specially met by drop doses of the diluted acid every 3 hours. In *eye disorders*, with involvement of the deeper tissues with atony, it is a pronounced remedy. The indication is *atony* of the eye and its appendages. It is indicated in nervous atony of the lid and ocular muscles, tobacco or alcoholic *amblyopia* (with nux if indicated), and in the *keratitis* of enfeebled persons. *Disseminated choroiditis* has been cured by it (Foltz). Externally it has been advantageously applied to *indolent ulcers*. From 1 to 30 drops may be given for a dose, mixed with an ounce or two of water, and this may be repeated 2 or 3 times a day.

Specific Indications and Uses.—Thirst; nervous and mental derangements; insomnia with atony; atonic nervous troubles of the eye and ear; functional deafness with debility.

Related Acid.—ACIDUM METAPHOSPHORICUM DILUTUM (N. F.). *Diluted metaphosphoric acid, Acidum phosphoricum glaciale dilutum, Diluted glacial phosphoric acid. Formulary number*, 7: "Glacial phosphoric acid one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; distilled water (enough to make one thousand cubic centimeters) (1000 Cc.) [33 fl℥, 391 ♏]." Dissolve the acid in the water without heat.

"This preparation should be kept in a cool and dark place, and should not be prepared in larger quantity than may be consumed within a few months.

"*Note.*—The resulting product contains about 10 per cent of metaphosphoric acid, provided the glacial acid was free from impurities. That which is sold in form of glassy lumps is usually of sufficient purity. The variety in form of round sticks is more or less impure, containing generally more than 15 per cent of phosphate of sodium. If this variety is alone available, a proportionately larger quantity must be taken, to be determined, if time permits, by an assay of the free acid present. If no special accuracy is required, about 115 Gm. [4 ozs. av., 180 grs.] of this variety of the acid may be reckoned to be equivalent to the quantity directed in the above-given formula.

"Whenever pyrophosphate of iron (*U. S. P.*) forms one of the ingredients of a mixture containing diluted phosphoric acid. the official tribasic acid is unsuitable, as it produces with the salt a gelatinous precipitate. If a clear mixture is required the above preparation is to be used in place of the official. The same may be done when phosphate of iron (*U. S. P.*) is prescribed, though the precipitate caused by the official acid in this case is not as bulky, and under certain conditions may not form at all"—(*Nat. Form.*).

ACIDUM PICRICUM.—PICRIC ACID.

FORMULA: $C_6H_2(NO_2)_3OH$. MOLECULAR WEIGHT: 228.57.

SYNONYMS: *Carbazotic acid, Nitrophenisic acid, Nitrophenolic acid, Nitropicric acid, Trinitrophenic acid, Trinitrophenol, Welter's bitter.*

Source and Preparation.—Picric acid is the product of the action of strong nitric acid on indigo, gum benzoin, coumarin, aloes, Australian gum, salicin, oil of gaultheria, phloridzin, silk, wool, leather, and other complex, organic substances, aided by heat, but is principally prepared from carbolic acid by the action of either nitric acid, followed by fuming nitric acid, or sulphuric acid and Chili saltpetre (nitrate of sodium). It is principally prepared from phenol, and the following formula is in frequent use: Take carbolic acid, 1 part; nitric acid, 3 parts; fuming nitric acid, 3 parts; warm the nitric acid and add the carbolic acid, drop by drop. This produces a violent reaction. After the violence of the reaction has abated, add the fuming nitric acid; heat, and evaporate the mixture, when picric acid will crystallize on cooling. Wash the product with cold water, and recrystallize with hot water or diluted alcohol.

An old formula, showing the preparation of picric acid from indigo, is as follows: Reduce the best indigo to a coarse powder, and digest it with ten times its weight of hot nitric acid, of specific gravity 1.430, added in small portions at a time. It dissolves with a copious emission of nitrous fumes, while it froths up very considerably. After the violent ebullition is over, raise it to the boiling temperature. Then add a little more concentrated nitric acid, continuing it, from time to time, as long as red fumes are disengaged. When the liquid has cooled there will be deposited a great quantity of yellow-colored, semi-transparent crystals; and if the process was properly conducted, neither resin nor artificial tannic acid makes its appearance. Wash these crystals in cold water and dissolve them in boiling water, and crystallize a second time. To obtain the picric acid quite pure, dissolve these crystals again in boiling water, and saturate them with carbonate of potassium; on cooling, crystals of picrate of potassium form. It is best to dissolve and crystallize them two or three times. When this salt is sufficiently pure, dissolve it in water and decompose it by nitric, hydrochloric, or sulphuric acid. When the solution cools, picric acid is deposited in beautiful crystalline plates. More of the acid may be obtained from the mother-liquors by a similar process. 4 parts of indigo yield about 1 part of picric acid. Great care is necessary to obtain it free from indigotic and oxalic acids.

Description.—Picric acid forms long, brilliant, whitish-yellow prisms with rectangular bases, which, in thin layers, are almost colorless. It reddens vegetable blues, and has an exceedingly bitter taste; it is fusible and volatile, and burns with a yellow flame, leaving a residue of charcoal. It is nearly insoluble in cold water, but soluble in hot water, alcohol, ether, benzol, chloroform, and petroleum benzin. It is not acted upon by chlorine, iodine, hydrochloric acid, nitro-hydrochloric acid, or cold sulphuric acid. Concentrated sulphuric or nitric acids dissolve it unaltered, and deposit it on the addition of water. Heated in an amount of water insufficient to dissolve it, the acid melts to a yellowish, transparent oil, which solidifies on cooling. Heated alone, the acid fuses to a yellowish oil; if the temperature be gradually raised, it may be partially sublimed; suddenly heated, it decomposes with explosion. It colors the skin, hair, and especially animal membranes, permanently yellow. It forms salts with bases, called picrates (carbazotates), which also detonate in high temperatures. Gelatin is precipitated by its solution in water. Its alcoholic solution is a good reagent for detecting the presence of potassium in sodium salts; the picrate of potassium is sparingly soluble, and is deposited in minute yellow crystals, while the picrate of sodium is very soluble. It will stain wood, and is much used by dyers to impart a permanent yellow color to silk and woolen goods. If it be used with indigo, various tints of green may be obtained. Picric acid and its ammonium salt are now extensively used in the production of "smokeless gun-powder." A saturated solution will show the presence of albumen in urine. Into a test-tube containing the solution, drop the urine, and if it contains albumen, at the point of junction of the two liquids a white line will be observed (Gallippe, *Ed. Med. Jour.*, 1873). More recently the picric acid test for albumen was modified by the additional use of citric acid (Esbach's solution, containing 2 per cent of citric and 1 per cent of picric acid). In the practice of medicine the name carbazotic acid is still in favor.

The aqueous solution, 1 to 100, is used as a laboratory test for alkaloids, most of which, excepting morphine, cocaine, coniine, caffeine, hyoscyamine, aconitine, and theobromine, will be thrown down from weak acidulous solutions.

Action and Medical Uses.—Picric acid and the picrates (carbazotates) impart a yellow coloration to the skin of man, and to the urine and conjunctiva in both man and animals. Diarrhœa, intestinal sanguineous extravasation, flatulent accumulations, depression, loss of flesh and muscular twitchings were observed in a rabbit.

This acid was formerly much used both internally and externally in various disorders, chiefly in *intermittents*, and *intestinal worms*. Picric (carbazotic) acid is tonic and astringent, the latter influence being effected by improving the general tone of the system. It has been efficaciously used in convalescence from acute diseases, *cephalalgia*, *chronic diarrhœa*, *gastric irritability*, *dyspepsia*, *anemia*, and *intermittent fever;* in which last disease it was once considered a valuable substitute for quinine, and is especially efficacious in those cases of *ague* in which, from continuous use, quinine has lost its effect. As the free acid is apt to occasion cramps in the stomach, the picrates of ammonium and iron have been found preferable. The picrate of ammonium and gallic acid, 1 grain each, with one-sixth of a grain of opium for a dose, may be repeated 3 times a day, in obstinate *diarrhœa*. By the use of these agents the skin and conjunctiva become temporarily colored, so as to closely resemble jaundice, and would deceive the keenest observer; the acid has been detected in the urine, even when this has been kept several days. Its intensely bitter taste is a bar to its use. The dose of the acid and its salts is from half a grain to a grain, repeated 3 times a day—(Moffatt, Crace Calvert). Webster suggests its possible curative action in *pernicious anemia* and *leukemia*, in 2 or 3 grain doses of the 3x or 6x triturations every 4 hours. It is now chiefly used as a laboratory reagent. An alcoholic solution may be applied to *burns*.

ACIDUM SALICYLICUM (U. S. P.)—SALICYLIC ACID.

FORMULA: $HC_7H_5O_3$. MOLECULAR WEIGHT: 137.67.

SYNONYMS: *Oxybenzoic acid*, *Ortho-oxybenzoic acid*.

"An organic acid, existing naturally, in combination, in various plants, but most largely prepared synthetically from carbolic acid"—(*U. S. P.*).

Source and History.—In the year 1839, an article, from the pen of M. Piria, stated that by heating salicin, with mixtures of bichromate of potassium and sulphuric acid, an oily product was obtained, which he named *hydrure of salicyle* (since known as salicylous acid). When this substance was heated with caustic potash, the mass dissolved in water, and then treated with excess of hydrochloric acid, a white substance crystallized, which Piria named *salicylic acid*. Soon afterward, Cahours and Gerhard obtained it, by decomposing wintergreen oil. Kolbe and Lautemann (*Ann. de Chim. et Pharm.*, cxiii.) succeeded in preparing salicylic acid, by passing carbonic acid gas through carbolic acid, at the same time adding fragments of metallic sodium. The residuum was dissolved in water and an excess of hydrochloric acid added, when impure salicylic acid separated. Afterward, Kolbe found that by preparing dry carbolate of sodium, and heating it to the temperature of 100° C. (212° F.), gradually increased to 220° C. (428° F.) [not to exceed 250° C. (482° F.)], while at the same time a constant stream of carbonic acid gas is kept passing through the retort, phenol will distill over, and disodium salicylate remain in the retort, thus: $2(C_6H_5ONa)+CO_2=C_6H_4ONa.CO_2Na+C_6H_5OH$.

This preparation was very impure, however, and it was not until after the year 1875 that, from this source, white salicylic acid became an article of commerce. Rautert (1875) found that pure salicylic acid would distill with a current of steam, thus enabling chemists to easily purify Kolbe's dark-colored or yellow preparation; and Dr. Squibb recommends this process in practice. At present, the bulk of salicylic acid found in commerce is prepared from carbolic acid. The following process, devised by R. Schmitt, was patented in 1885. Phenol-sodium is acted upon by a current of carbon dioxide (CO_2) at ordinary temperature, resulting in the formation of sodium phenyl carbonate as follows: $C_6H_5ONa+CO_2=C_6H_5O.COONa$. This substance is then heated in closed vessels to a temperature of 120° C. to 140° C. (248° F. to 284° F.), an intramolecular change taking place, whereby monosodium salicylate ($C_6H_4OH.COONa$) is produced; from this salt salicylic acid is easily liberated by hydrochloric acid. Salicylic acid is likewise found in the leaves of wintergreen (*Gaultheria procumbens*), and in allied plants, as methyl-salicylate ($C_6H_4[OH].COCH_3$). Cahours and Gerhard discovered it in the former about 1843. Cahours also obtained it while fusing a mixture of indigo and hydrate of potassium at high temperature; and Delandes, by a somewhat similar action, upon coumarin. Distilled *oil of meadow sweet* (*Spiræa ulmaria*) readily yields it, as this oil is, mainly, salicylous acid ($C_7H_6O_2$). Prof. E. S. Wayne obtained salicylic acid, from an oil, distilled from buchu leaves, and Prof. J. U. Lloyd (1877) from an oil, obtained by distillation from senega root. [This oil proved to be identical, in character, with oil of wintergreen]. Mandelin (1881) proved its existence in several species of violets.

Preparation.—To prepare salicylic acid, dissolve, in an evaporating dish, 2½ parts of white hydrate of potassium, by means of a similar amount of distilled water, and raise the temperature of the solution to 82.2° C. (180° F.); then add, with constant stirring, 3 parts of oil of wintergreen (*Gaultheria procumbens*). When effervescence ceases, pour the solution into a mixture, composed of hydrochloric acid, 4 parts, and distilled water 10 parts; stir well, and allow the mixture to remain in a cool place for 24 hours; then pour it upon a muslin strainer, drain the crystalline magma, redissolve it in boiling water, and crystallize by cooling; or, dissolve the precipitate in alcohol, and then reprecipitate, by the addition of water. Pure wintergreen oil must be employed in this process, because, if adulterated with sassafras oil, as is often the case, much trouble will be experienced in purifying the acid.

Description and Tests.—Salicylic acid separates from concentrated solutions, when rapidly cooled, in the form of small, crystalline tufts of minute acicular crystals. It is inodorous, but the crude salicylic acid in course of preparation, from wintergreen oil, possesses, from the presence of foreign matters, the peculiar odor of fresh willow bark, an odor familiar to those who have visited willow plantations, and have become impressed with the exhalation from freshly-stripped willows. When pure, this acid imparts, at first, a sweetish taste, which quickly becomes acrid and disagreeable. It sublimes, when gradually heated, but, according to Biel, after sublimation it has a tendency to spontaneously decompose into carbolic acid and carbonic acid gas. It unites with alkalies to form salts, the sodium salicylate being considerably employed in medicine. The dust of salicylic acid is irritating, if inhaled, exciting coughing and a sense of suffocation. In making solutions of salicylic acid in water, phosphates or acetates of the alkalies are often added, as salicylic acid is very soluble in these solutions. It is stated that a compound of borax with salicylic acid, $Na(B.OH)2C_7H_5O_3$ may be formed, and in practice, it is customary for physicians to add borax when desiring to make an aqueous solution of the acid. This solution soon acquires a bitter, unpleasant taste. The official acid is thus described: "Light, fine, white, prismatic needles, or a light, white, crystalline powder; odorless, having a sweetish, afterward acrid taste, and permanent in the air. Soluble at 15° C. (59° F.), in about 450 parts of water, and in 2.4 parts of alcohol; in 14 parts of boiling water, and very soluble in boiling alcohol. Also soluble in 2 parts of ether, 2 parts of absolute alcohol, and 80 parts of chloroform. When heated to 156° C. (312.8° F.), the acid begins to melt, and is completely melted at 157° C. (314.6° F.); at a higher temperature it is gradually dissipated without leaving more than 0.6 per cent of fixed residue. The saturated aqueous solution has an acid reaction, and is colored intensely bluish-violet (in high dilution violet-red) by ferric chloride T.S."—(*U. S. P.*).

Cresotic Acid, $C_8H_8O_3$—, is a homologue of salicylic acid, and the properties of commercial salicylic acid are said to be often considerably modified by its presence. It is more soluble in boiling water, but likewise, produces the violet reaction with ferric chloride. This impurity, as well as phenol, is liable to be found only in salicylic acid artificially prepared from carbolic acid. That made from wintergreen oil may contain chloride of potassium, recognized by remaining insoluble, when the acid is washed with excess of alcohol. For medicinal use, the acid from wintergreen is often preferred by physicians.

"On adding to a small portion of salicylic acid, in a test-tube, about 1 Cc. of concentrated sulphuric acid, then, cautiously, about 1 Cc. of methylic alcohol, in drops, and heating the mixture to boiling, the odor of methyl salicylate will be evolved. On allowing a saturated alcoholic solution of the acid to evaporate spontaneously in a glass or porcelain capsule, in a place protected from dust, a perfectly white, crystalline residue should remain (absence of iron, carbolic acid, or coloring matter). If 1 Gm. of the acid be dissolved in an excess of cold sodium carbonate T.S., the liquid agitated with an equal volume of ether, and the ethereal solution allowed to evaporate spontaneously, the residue, if any should be free from the odor of carbolic acid. On treating about 0.5 Gm. of the acid, in a clean test-tube, with 10 Cc. of concentrated sulphuric acid, no color should be imparted to the latter within 15 minutes (absence of readily carbonizable, organic impurities). A solution of 0.5 Gm. of the acid in 10 Cc. of alcohol, mixed with a few drops of nitric acid, should remain unaffected upon the addition of a few drops of silver nitrate T.S. (absence of hydrochloric acid)"—(*U. S. P.*)

Action.—According to MM. Chirone and Petrucci, animals subjected to the daily ingestion of this acid, rapidly emaciate, and lose much of their weight. With frogs and mammifers, it always diminishes the number of pulsations; in large doses it elevates the temperature of the body, and diminishes the number of respirations; in small doses it lowers the temperature. According to others, its use is apt to occasion more or less deafness, tinnitus, pain in the forehead, manual tremors, and accelerated respiration; and very large doses induce intense cephalalgia, tremors, excessive debility, hurried respiration, some lesion of the kidneys, and tingling sensations in the extremities, and, in some instances, rapid collapse, and cerebral symptoms, varying from those resembling cinchonism to nearly acute delirium. Sudden temporary amaurosis (Gatti) with recovery in 10 hours, occurred in an individual to whom 125 grains of sodium salicylate had been administered. Dimness of vision, ptosis, and strabismus are not uncommon results from its use. H. Kohler states that it depresses the respiratory activity, and may even occasion death by asphyxia. Auger observes that its prolonged use in large doses, especially with women, is very apt to occasion nausea, vomiting, pyrosis, diarrhœa, angina, tinnitus, and even deafness, redness of the face, and slight congestion; and that, with inebriates, it may determine a furious delirium. These results, he adds, may sometimes be prevented or mitigated, by administering it in milk, or in unleavened bread with a cup of milk. Pye Smith has observed that the urine of a patient who had been taking salicylic acid, gave the characteristic saccharine reaction, with the copper test; while Muller and others have found its sodium salt to temporarily, or permanently, as the case may be, cause the diabetic sugar to completely disappear. M. Gubler observes, that when the kidneys are normal the use of salicylic acid occasions diuresis, while, on the contrary, the urine is in diminished amount and even albumen is present in, more or less, considerable quantity, when there is a lesion of these organs. Salicylic acid imparts to the urine a characteristic olive-green tint. M. Bucquoy cites a case in which abortion, at the sixth month, followed the administration of this acid; and he also inquires whether the rapid deaths of certain patients, treated with this acid, and especially when the doses were large, may not be due to uremia, occasioned by its use. One or two writers have stated that the osseous system is affected by its use, and we are aware of several instances in which caries of the teeth occurred after a treatment with salicylic acid; but whether due to this acid is a question yet to be determined. Many of the serious symptoms following its employment have been attributed to an impure preparation; yet as such symptoms have been observed, it behooves the medical practitioner, not only to be certain that he is employing the pure acid, but, likewise, to be careful in its administration, and to closely watch its effects, that he may be the better prepared to promptly remove any undesirable symptoms that may arise therefrom. The irritating action of this acid, upon the mucous membrane of the mouth, pharynx, œsophagus, etc., is said to be due to impurities; but the pure acid will occasion a dryness of the mucous membrane, followed by slight burning and increased saliva.

If a solution of salicylic acid be sprayed upon plants they quickly die. Added to milk and beer it prevents organic changes by checking the fermentative processes. If added to urine it will stop all putrefactive processes, and if it be ammoniacal, it will be promptly deodorized. Fermentation of urine within the bladder may be checked by the internal administration, or by injection, of solutions of this acid or one of its alkaline salts.

Medical Uses and Dosage.—The therapeutical virtues of salicylic acid are not satisfactorily determined; while many physicians highly extol it, as possessing certain valuable properties, as many others, on the other hand, emphatically deny this, and attribute the results following its employment to other causes. By various investigators, it has been claimed that salicylic acid is an antiseptic and germicide; by others, that it is a disinfectant, a deodorizer, an astringent, and an antipyretic. Kohler and some others consider it an antiseptic and germicide only when locally applied, because when taken internally it becomes united with an alkali, loses its antiseptic action, and produces effects similar to those following the ingestion of sodium salicylate. MM. See, Laborde, and others, state that the good effects following its internal administration are entirely due to its action as an analgesiant, and deny that it has any antiseptic, antipyretic, or antiperiodic action, when thus employed. Prideaux speaks highly of its efficiency in *smallpox*, when in combination with ammonium and sodium salts; his formula is a mixture of carbonate of ammonium, carbonate of sodium, each 5 grains, salicylic acid 20 grains, water 1 fluid ounce; the dose is one-half, or the whole, of this solution, given every 4 or 6 hours. It is pleasant to the taste, unirritating to the intestinal canal, and modifies the disease so as to arrest it in its second and third stages, and also to prevent pitting, after recovery, in consequence of the absence of pus formation (*Braithwaite's Retrospect*, January, 1878, p. 188, from *Med. Exam.*). Letzerich states that upon the addition of salicylic acid to the diphtheritic organisms in the urine of children affected with severe *diphtheria*, and which consisted of bacteria, micrococci, and protoplasmic masses, the bacteria were destroyed, and the corpuscles of the plasmic substance became dim, presented a double margin, and apparently contained air-bubbles. He considers it a powerful anti-diphtheritic agent, and has successfully treated several cases of the disease, using a solution of the acid as a gargle, and applying the pulverized acid over the affected surface. Others, again, have derived no benefit whatever from its employment in diphtheria. But it is useless to continue these discordant statements, from which it will readily be seen that even its acknowledged partisans are not agreed as to its therapeutical virtues, and that our knowledge concerning its value is still very imperfect; and until more satisfactory information concerning its action shall be had, it will be advisable to employ it with great care and prudence, to closely watch its effects, and to at once suspend its administration whenever any unexpected symptoms appear, or when any doubt exists as to its influences upon the system, or any of its organs. Salicylic acid, and its salts, appear in the urine, partly free, partly in the form of salicyluric acid, in from 20 to 30 minutes after its ingestion, and may be known by the violet color produced when a solution of ferric chloride has been added to this fluid; also, by its deviating to the left the plane of polarization, from the presence of salicin.

Salicylic acid, as well as its salts, as salicylate of sodium, of calcium, of lithium, of ammonium, of quinine, have undoubtedly been found of great value in *acute articular rheumatism*, rapidly reducing the temperature and the pulsations, and mitigating the pain, thus tending to prevent serious complications, allowing the excretory organs to eliminate any nocuous substance, and lessening the intensity and duration of the disease. As with all remedies, failures may occur, chiefly owing to the treatment with the acid not having been commenced until after the existence of complications, or from want of perseverance in following up the treatment, as from the rapid elimination of the acid from the system, it requires to be frequently and persistently administered in order to be of any avail. The acid may be given in doses of from 5 to 10 grains, repeated every hour or two. Without doubt the drug is practically useless in chronic cases. Prof. John M. Scudder believed the drug useful in cases of *acute*, or *sub-acute rheumatism*, with but little febrile reaction, the tongue being full, moist, purplish, or leaden-colored, and where the rheumatic area exhibits local redness, with slight purplish discoloration, especially when pressed upon; as an antirheumatic he preferred 2-grain doses every 2 hours. According to Prof. F. J. Locke, it is always contraindicated by a pointed, red tongue. He prefers to use it in combination with potassium acetate. It has likewise been used in *gout*, to lessen pain and favor the elimination of the sodic biurate present in the blood in excess, but it should not be administered to gouty patients whose urine contains albumen; though Dr. S. J. Sharkey and some others doubt whether the medicine has anything to do with the presence of albumen in the urine, as this substance is encountered in the urine of rheumatic patients with high temperature; still, it is better to observe caution until the matter is settled definitely. In *acute diseases*, *intermittents*, etc., it has failed as frequently as it has proved successful; and, indeed, doubts exist as to whether the successful results can be attributed to its action. It has been proclaimed useful in *aphthæ*, *thrush*, *lumbago*, *neuralgia*, *diabetes*, *hectic fever*, etc., but further investigations are necessary before any reliance can be placed upon its use in these affections. As the rule, the administration of one of its salts is preferable to the pure acid, especially its sodium salt, on account of its more perfect solubility, its milder action, and its more agreeable taste. When salicylic acid, or any of its salts, is found to disagree with the stomach, occasioning uneasiness, nausea, or other unpleasant feelings, these may be prevented or mitigated by the administration of an aromatic tincture or infusion, with each dose. It is a good remedy in *dyspepsia* with yeasty fermentation. Given internally it removes *lumbricoides*, and by injection destroys the *ascaris vermicularis*.

As a local application, a spray of solution of salicylic acid has been found serviceable in *ozena*, *fetid bronchitis*, *chronic pharyngitis*, *aphthæ*, *pulmonary gangrene*, and other maladies attended with offensive odor, as *bad breath* from *carious teeth;* and it is a very efficient agent in *fetid perspiration*, especially of the feet and axillæ. In *phthisis* its use should be extremely guarded, as it has even produced hemoptysis in the healthy man. In *diarrhœa* and *dysentery*, also in *leucorrhœa* and *gleet*, used in injection, it has proven useful, especially in removing fetor; in these cases it should be used in solution considerably diluted, as a strong solution is apt to be quite irritating.

In diseases due to or attended with minute organizations (fungi), as *diphtheria*, *parasitic cutaneous maladies*, *hay fever*, *coryza*, etc., its application in solution, or in dry powder, has been productive of benefit; in *ulcers*, *suppurating wounds*, and *gangrene*, it forms a very useful dressing, though probably inferior to thymol, or carbolic acid. Prof. Scudder regarded this agent as an antipyic, and considered it one of our best antiseptic agents. He employed it in open *wounds* to prevent the formation of pus, and to correct offensive odors. *Typhlitis* and *perityphlitis*, with or without suppuration, are benefited by it. It is valuable in *septicemia* to correct blood dyscrasia, and especially so in *puerperal fever* (Webster). Mixed with an ointment base, it has removed *freckles*, and combined with collodion and cannabis indica, has been recommended for the removal of *corns*. On account of its corrosive action on steel, it is not a good agent with which to cleanse surgical instruments. Dr. W. N. Mundy (*Annual of Eclectic Med. and Surg.*, Vol. 1), is authority for the statement that this acid is an excellent local application for *rhus poisoning*, and that a saturated solution with collodion will cure *ringworm*, a second application being rarely needed. Prof. A. J. Howe valued it in *pruritis ani* and *rectal fissures*. Lithium salicylate has given good results in *chronic cystitis*, and calcium salicylate has been highly praised for its action on *syphilitic chancre*.

Foltz reports good results in the scaly and exudative forms of *eczema* of the eyelids by the use of an ointment (salicylic acid [Lloyd's] grs. v to xx, petrolatum ℥j), and also employed a 4 per cent glycerin solution to destroy the false membrane in *diphtheritic conjunctivitis;* while Webster regards it curative in *rheumatic ophthalmia* and in *myalgia* of the ocular region (*Dynam. Therapeutics*).

While salicylic acid and the salicylates are excellent remedies when indicated, they should be very cautiously employed where there is any existing *cardiac trouble*. In fact, the main objection to the use of these drugs is their dangerously depressant action on the heart. They are also contraindicated in *diseased conditions of the kidneys*, and especially so if disintegration of the renal structures is taking place. *Typhoid fever* and *typhoid states* are not benefited by this acid or its salts, but on the contrary their action is often deleterious. The untoward effects of the salicylates are said to be somewhat mitigated by the administration of ergot.

The following formulæ have been given for the administration and application of salicylic acid; the solutions, it will be observed, are salicylates of the alkalies entering into them: 1. Salicylic acid, 30 grs.; citrate of ammonium, 40 to 45 grs.; water, 4 fl℥. Mix. Or, salicylic acid, 30 grs.; citrate of ammonium, 15 grs.; rum or brandy, ½ fl℥; distilled water, 2½ fl℥. Mix. The dose is 1 to 2 tablespoonfuls (A. Casson). 2. Salicylic acid, 180 grs.; carbonate of ammonium, 90 grs.; water, 6 fl℥. Mix. Dose, a tablespoonful every 3 hours (J. A. E. Stuart). 3. Salicylic acid, 60 grs.; borax, 30 grs.; glycerin, 1½ fl℥. Mix the acid and borax with half an ounce of the glycerin, and heat until solution is effected, then add the balance of the glycerin. For internal and local application. 4. Salicylic acid, 30 to 60 grs.; white wax, 60 grs.; paraffin, 120 grs.; almond oil, 2 drachms. Mix, melt, and rub up in a heated mortar. Spread on strips of muslin or fine linen. This is an excellent antiseptic application, and also useful in *eczema*, *rodent ulcer*, etc. (Lister). 5. Salicylic acid, 10 grs.; borax, 6 grs.; water, 6 fl℥. Mix, heat, and while the solution is hot, saturate clean cotton with it, and allow it to dry. This cotton forms a valuable dressing for surgical purposes. 6. Salicylic acid, 10 drachms; pure olive oil, 16 ounces. Mix, heat, and rub in a heated mortar. Lint or cotton saturated with this oily solution, forms a very satisfactory application to *burns*, *scalds*, *eczematous affections*, etc. Antirheumatic dose: 2 grains, in pill or capsule, every 3 hours, until 20 grs. are taken. Lotion: Salicylic acid, borax, āā ℨj; aqua, Oj.

Specific Indications and Uses.—Antirheumatic; rheumatic pain, with but little fever; sub-acute rheumatism. Tongue, broad, full, purplish, or leaden-colored, showing spots where the fur is detached; chronic catarrh of mucous tissues.

Related Products.—ACIDUM SALICYLACETICUM, *Salicylacetic acid.*—Salicylacetic acid is obtained by heating 169 parts of dry sodium salicylate with 100 parts of a 40 per cent solution of caustic soda. After the mixture is cold add to it 130 to 140 parts of sodium monochloracetate, heat to 120° C. (248° F.), and then neutralize the mixture with diluted hydrochloric acid. It is insoluble in ether, which removes from it remaining traces of salicylic acid; and it is generally irresponsive to the common solvents. It is antiseptic, forming also an antiseptic salt when combined with antipyrin.

CRESOTIC ACID, *Cresotinic acid*, *Homosalicylic acid*, *Oxytoluic acid* ($C_6H_3CH_3OHCOOH$).—Many isomers of this acid exist, four of which are homologues to salicylic acid. Three of these are known as ortho-, meta-, and para-cresotic acids, according to their preparation from ortho-, meta-, or para-cresol, in the same manner as salicylic acid is obtained from phenol. Only the para compound is used medicinally, and that has been replaced by *sodium cresotate.* Paracresotic acid occurs in long prisms, fusing at 151° C. (303.8° F.), scarcely soluble in cold, but more readily in hot water, and easily soluble in alcohol, chloroform, and ether. *Sodium cresotate* is a fine, white powder, bitterish, but not unpleasant to the taste, and soluble in 24 parts of hot water, the solution being permanent. Divided doses of from 60 to 90 grains have been given daily, and it is said to act better as an antipyretic and antirheumatic than salicylic acid. On the other hand, it has been charged with causing cutaneous erythema and dangerous collapse.

SULPHOSALICYLIC ACID, *Sulpho-sulphonic acid*, *Salicyl-sulphonic acid* ($C_6H_3SO_3H.OH.COOH$).—Produced by acting upon salicylic acid with concentrated sulphuric acid. Colorless needles soluble in water and alcohol. A delicate test for proteids—fibrin, globulins, peptones, and albumen, $\frac{1}{12500}$ part of the latter being detected by it. A dense white precipitate falls, which, when boiled, dissolves and reappears when the solution is allowed to cool, if the substance be an albumose or peptone. With the other bodies the precipitate does not redissolve on boiling.

ACIDUM PHENYLO-SALICYLICUM.—An acid whose salts are said to be less poisonous than those of salicylic acid, and possessing the germicidal properties of the latter. A powder, whitish, readily soluble in alcohol, glycerin, and ether, and sparingly in water.

ACIDUM ORTHO-AMIDO-SALICYLICUM.—A nearly odorless, non-crystalline, grayish powder, feebly sweetish, and not soluble in alcohol, water, or ether. Has been used by Neisser (*Inaug. Dissertation*, Bern, 1892) in sub-acute forms of *rheumatism*, with apparent success.

ACIDUM STEARICUM (U. S. P.)—STEARIC ACID.

FORMULA: $HC_{18}H_{35}O_2$. MOLECULAR WEIGHT: 283.38.

"An organic acid, in its commercial, more or less impure, form, usually obtained from the more solid fats, chiefly tallow"—(*U. S. P.*).

Source and Preparation.—Stearic acid may exist in limited quantities in a free state, and, together with palmitic acid, is present in the form of a glyceride in many of the oils and in most solid fats. It also exists free in the intestines when fats are undergoing digestion. It may be obtained pure by saponifying fats with an alkali, and decomposing the soap so formed with hydrochloric acid. The resulting fatty acids are dissolved in excess of alcohol and heated. The boiling solution is then acted upon with a strong solution of acetate of barium. The precipitate, after having been washed, is then decomposed with hydrochloric acid, whereupon the stearic acid separates, and is treated with alcohol, from which it is recrystallized. Recrystallization is repeated until the crystals melt at about 70° C. (158° F.).

Description and Tests.—"A hard, white, somewhat glossy solid, odorless and tasteless, and permanent in the air. Insoluble in water; soluble in about 45 parts of alcohol at 15° C. (59° F.); readily soluble in boiling alcohol and in ether. Stearic acid when pure melts at 69.2° C. (156.6° F.). The commercial acid should have a melting point not lower than 56° C. (132.8° F.), and the melted acid should not become opaque and begin to congeal at a temperature lower than 54° C. (129.2° F.). If 1 Gm. of stearic acid and 1 Gm. of sodium carbonate be boiled with 30 Cc. of water in a capacious flask, the resulting solution, while hot, should not be more than opalescent (limit of undecomposed fat)"—(*U. S. P.*).

Uses.—This acid, combined with sal soda (sodium carbonate), is employed in the preparation of glycerin suppositories. The stearate of zinc forms a protective against fluids, and is useful as a dressing powder in *pruritic complaints.*

ACIDUM SULPHURICUM (U. S. P.)—SULPHURIC ACID.

FORMULA: H_2SO_4. MOLECULAR WEIGHT: 97.82.

SYNONYMS: *Hydrogen sulphate, Oil of vitriol.*

Source and History.—Sulphuric acid is the most extensively used of the acids, being consumed in enormous quantities in almost every branch of commercial industry. It was first prepared (about 1440) from "calcined vitriol" (green vitriol) by an industrious monk, Basil Valentine, of Erfurt, Saxony, and its composition ascertained by Lavoisier, in 1777. The name "oil of vitriol" was given it by the former. Combined in minerals, such as Epsom salts (magnesium sulphate), heavy spar (barium sulphate), and gypsum (calcium sulphate), it is quite extensively distributed over the earth. Unlike nitric and hydrochloric acids, it can not easily be made from its salts, but is prepared almost entirely by the oxidation of sulphur dioxide in the presence of water, the dilute solution being afterward concentrated. It is sometimes, though rarely, found uncombined in nature, the waters of the Rio Vinagre of South America containing it in sufficient quantities to render it appreciably sour. It exists free in the salivary glands of certain mollusca and in the waters of a few mineral springs—the Oak Orchard Mineral Spring at Medina, N. Y., containing 1½ Gm. to the liter.

Preparation.—Sulphuric acid is made in enormous quantities by passing into lead chambers, supported in a wooden frame-work, vapors of sulphur dioxide, nitric acid, jets of steam, and a certain quantity of atmospheric air. The sulphur dioxide is obtained by roasting iron pyrites, or burning crude sulphur; and the nitric acid, from the action of sulphuric acid on sodium nitrate. By a series of reactions of these substances on each other, a diluted acid, known as "chamber acid," results. This product is too weak for most industrial purposes (its density being 1.550), consequently it is drawn off into leaden evaporating pans, and condensed until its density reaches 1.750, when it begins to corrode the lead, and further concentration is carried on in glass or platinum stills.

Sulphuric acid for medicinal use can only be purified by distillation in glass retorts. This is a dangerous operation, from the fact that the retort is liable to be broken by the excessive heat required to bring the acid to the boiling point, 338° C. (640.4° F.). The glass retort must be imbedded to the neck in a sand-bath connected with a receiver, and heat applied. After about one-eighth or one-sixth of the acid has passed over, another receiver is connected in place of the former, which is removed, and the remaining distillate will then have the required density. No luting should be used to connect the retort and receiver, but a metallic hood over the former is advisable. To prevent bumping caused by the vapors, a few fragments of sharp-pointed glass, clay pipe-stems, or quartzite (Lembert), may be placed in the liquid in the retort, taking the precaution to replace them or add more as soon as their points become worn off. If possible, an acid free from arsenic should be employed for purification. Much of the English acid contains this impurity, on account of being made from iron pyrites, which contains it in considerable quantities. Acid made from Sicilian sulphur, however, is comparatively free from it, which is true also of much of the acid now made in this Country, though there have recently arisen factories in the United States, in which pyrites containing arsenic is employed. The removal of arsenic from sulphuric acid is carried out on a large scale according to either of the two following principles: 1. Precipitating the arsenic as sulphide by means of hydrogen sulphide, either in the concentrated, or preferably, the somewhat diluted acid. 2. By volatilizing the arsenic as trichloride by means of hydrogen chloride gas conducted into the acid, which is afterward heated to a temperature somewhat above 134° C. (273° F.) to facilitate the expulsion of the arsenous chloride. If arsenic is present in the form of arsenic acid, this must first be reduced to arsenous acid, by means of sulphurous acid gas, or heating the acid with a little charcoal.

FUMING SULPHURIC ACID, *Acidum sulfuricum fumans.*—This acid is also known as *Nordhausen oil of vitriol*, from the fact that it was first made at Nordhausen, in Saxony. It was prepared at an earlier date than ordinary oil of vitriol. It is really a sulphur trioxide (SO_3) dissolved in sulphuric acid, and is made by roasting ferrous sulphate (obtained from pyrites-bearing slate) to redness in earthenware retorts, and distilling. The acid fumes pass over, leaving ferric oxide in the retort. The latter is then sold as a polishing material, under the name of *colcothar* or *rouge.*

Description.—I. SULPHURIC ANHYDRID, or *Anhydrous sulphuric acid* (SO_3), is a white, crystalline solid, which melts at 20° C. (68° F.), and boils near 35° C. (95° F.). It gives off thick fumes in moist air, and has so strong an affinity for the elements of water that when thrown into that fluid it hisses like red-hot iron, combining with the water to form oil of vitriol. It is prepared from the Nordhausen acid. It does not redden litmus unless moisture be present.

II. NORDHAUSEN OIL OF VITRIOL, is an oily fluid, usually brownish in color from organic impurities present. It gives off copious, white, irrespirable fumes; when cooled to 0° C. (32° F.) it congeals, forming white crystals of the composition $H_2SO_4+SO_3$, and melting at 35 °C. (95° F.). This compound is called pyrosulphuric acid ($H_2S_2O_7$), because it forms a number of stable salts. It boils when heated to between 40° C. (104° F.) and 50° C. (122° F.), yielding anhydrous sulphuric acid.

III. COMMERCIAL OIL OF VITRIOL.—Crude sulphuric acid is of a heavy, oily consistence, odorless, and colorless if free from organic matter. It is often, however, of a yellowish or dark-brown appearance, due to the presence of such organic material as dust, cork, straws, etc., and will quickly disintegrate flesh. Even after much dilution it has an intensely sour taste. It should be free from arsenic if to be used for pharmaceutical purposes, but unfortunately this impurity, as well as lead sulphate, is frequently present.

IV. ACIDUM SULPHURICUM (*U. S. P.*), *Sulphuric acid.*—"A liquid composed of not less than 92.5 per cent, by weight, of absolute sulphuric acid (H_2SO_4= 97.82), and not more than 7.5 per cent of water. The above-named percentage (92.5) is that assumed for sulphuric acid in the formulæ of pharmacopœial preparations. Sulphuric acid should be kept in glass-stoppered bottles"—(*U. S. P.*).

It forms "a colorless liquid, of oily consistence, inodorous, and very caustic and corrosive. Specific gravity, not below 1.835 at 15° C. (59° F.). Miscible in all proportions, with water and alcohol, with evolution of so much heat that the mixture requires great caution. It boils at 338° C. (640.4° F.). When heated on platinum foil it is vaporized without leaving a residue. Even after dilution with much water it shows an intensely acid reaction with litmus paper"—(*U. S. P.*).

Owing to its great affinity for water, sulphuric acid is so intensely corrosive that it will rapidly destroy the tissues. If a piece of wood or a lump of sugar be dipped into the acid it will abstract from it the elements of water, leaving behind a charred mass of carbon. When mixed with water a great amount of heat is developed, depending partly on the energetic chemical action, and partly on the condensation which takes place; on this account, when exposed to the atmosphere, its absorption of moisture rapidly reduces its strength. It unites with water in all proportions, and the heat evolved is so great as to endanger the glass container, which may be avoided by adding the acid gradually. Water should never be poured into the acid, but, on the contrary, if a solution be required, the *acid should be gradually added to the water*, and, preferably, a porcelain dish should be used in which to mix it. Combined with bases, sulphuric acid forms salts called sulphates.

V. ACIDUM SULPHURICUM DILUTUM (*U. S. P.*)—*Diluted sulphuric acid.*

Preparation.—"Sulphuric acid one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; distilled water eight hundred and twenty-five grammes (825 Gm.) [1 lb. av., 13 ozs., 44 grs.]. To make nine hundred and twenty-five grammes (925 Gm.) [2 lbs. av., 275 grs.]. Pour the acid gradually, under constant stirring, into the distilled water. Keep the product in glass-stoppered bottles"—(*U. S. P.*).

Description.—This is a thin, colorless liquid, having a pure, sour taste. "Diluted sulphuric acid contains 10 per cent, by weight, of absolute sulphuric acid. Specific gravity about 1.070 at 15° C. (59° F.). It should respond to the reactions and tests given under sulphuric acid (see *Acidum Sulphuricum*). To neutralize 4.89 Gm. of diluted sulphuric acid should require 10 Cc. of normal potassium hydrate V.S. (each Cc. corresponding to 1 per cent of the absolute acid), phenolphtalein being used as indicator"—(*U. S. P.*).

Impurities and Tests.—Among the impurities liable to be found in sulphuric acid are: Organic matter, which colors the acid brownish or black; arsenic, which may be detected by Marsh's test, or according to the *U. S. P.* test to follow; selenium, which, when the acid is diluted with alcohol, falls down in the form of a red powder. The presence of sulphuric acid in the smallest quantity, whether free or combined, is detected in solutions by the characteristic property of forming, with any soluble compound of barium (as the chloride or nitrate), a precipitate of sulphate of barium, which is not only insoluble in water, but also in strong acids, except in concentrated sulphuric acid; from this solution it is reprecipitated by water. Free sulphuric acid in dilute solution may be recognized, by adding some crystals of sugar and evaporating on the water-bath nearly to dryness, whereby a black or brown color is produced if sulphuric acid was present. Sulphuric acid reddens salicin, piperin, veratrine, phloridzine, oil of bitter almonds, etc.

The *U. S. P.* tests for the purity of sulphuric acid, are as follows: "Diluted with 5 volumes of water, it yields, with barium chloride T.S., a white precipitate insoluble in hydrochloric acid. On mixing the acid, carefully, with 4 or 5 volumes of alcohol, no precipitate should be formed within one hour (absence of lead). If there be carefully poured upon it, in a test-tube, a layer of ferrous sulphate T.S., the zone of contact should not assume a brown or reddish color (limit of nitric or nitrous acid). In sulphuric acid, diluted with 20 volumes of water, no precipitate should be formed by the addition of silver nitrate T.S. (absence of hydrochloric acid), or of hydrogen sulphide T.S. (absence of lead, arsenic, copper); nor by supersaturation with ammonia water (iron); nor should the acid thus supersaturated leave any fixed residue on evaporation and ignition (absence of non-volatile impurities), nor yield any precipitate on addition of ammonium sulphide T.S. (iron, thallium, etc.). 1 Cc. of sulphuric acid, diluted with 5 Cc. of water, and cooled, should not at once discharge the color of 0.1 Cc. of decinormal potassium permanganate V.S. (limit of sulphurous or nitrous acid). If 1 Cc. of a mixture of 1 volume of sulphuric acid with 2 volumes of water be mixed with 1 Cc. of stannous chloride T.S. (see *List of Reagents*, Bettendorff's Test for Arsenic), and a small piece of pure tin-foil added, no coloration should appear within one hour (limit of arsenic). To neutralize 0.489 Gm. of sulphuric acid, diluted with about 10 Cc. of water, should require not less than 9.25 Cc. of normal potassium hydrate V.S. (each 0.1 Cc. corresponding to 1 per cent of the absolute acid), phenolphtalein being used as indicator"—(*U. S. P.*).

Uses in the Arts and Pharmacy.—Sulphuric acid is very extensively used in almost every branch of the arts. In pharmaceutical operations it is the most universally employed of all acids, viz.: To liberate hydrogen from zinc and water; in purifying chloroform and other bodies, by extracting organic impurities; for drying gases and other bodies; in the preparation of many other acids; to refine paraffine and petroleum products; in preparing the aromatic sulphuric acid, the sulphates, sulphurous acid, oil of wine, sulphuric ether, alkaloids, pyroxylin, hides for tanning, chlorinated lime, phosphorus, soda, alum, persulphate of iron; and in making solutions of indigo, etc.

Action and Toxicology.—The protracted use of diluted sulphuric acid, is exceedingly deleterious in its effects on digestion, and may give rise to diarrhœa, with consequent weakness and loss of flesh. It is at all times and in all conditions destructive to the teeth. It slows the pulse, increases the appetite, allays thirst, and checks excessive cutaneous excretion. Injected into the venous circulation, the strong acid coagulates and chars the blood. The pure acid destroys flesh, redissolving coagula, and penetrates deeply, carbonizing the tissues wherever it touches. If swallowed in any amount, death is almost sure to follow, as the tissues over which it passes are utterly destroyed. The symptoms are intense burning pain, escape of gaseous or frothy material, retching, and vomiting of shreds of tissue and dark, coffee-ground and bloody fluid, and excoriation of the parts over which the acid passes, giving them a whitish appearance, as of parchment that has been soaked. This whitish hue subsequently changes to gray or brownish, and the mouth is filled with a thick, sticky mixture of mucus, saliva, and corroded tissue. Breathing, speaking and swallowing are very difficult, and the face assumes a livid or bluish appearance. If breathing be not obstructed, from injury to the larynx, the face is pale and the expression extremely anxious and indicative of intense suffering. Pain is increased upon the ingestion of fluids, and upon movement of the abdominal muscles. Exhaustion, great weakness, small, feeble, quick pulse, cold, mottled skin, bathed in clammy sweat, great thirst, obstinate constipation and convulsive movements, are also symptomatic. The intellect remains unimpaired until death. If death is not immediately produced, it may subsequently result from œsophageal stricture, or gastric inflammation and ulceration; in either case causing death by starvation. It should be antidoted with calcined magnesia, if at hand; if not, other alkaline solutions may be given. Emetics and alkaline carbonates should, if possible, be avoided, and the stomach-pump used with the greatest of care. Mucilaginous drinks, milk, albumen and soaps may be given after the antidotes if the acid swallowed be small in amount, or in a diluted form. After death, the parts are found corroded, and colored whitish, gray or brown-black, with ecchymoses. The stomach may be perforated, but if not, it is collapsed and its tissues contracted, the stain being black or brown over the entire surface, or merely in black streaks, according to the amount of food in the organ. The contents are of the same hue, and tarry in consistence. If perforation occurs, other neighboring organs may be attacked. Death from poisoning by this acid, usually occurs in from 18 to 24 hours. The smallest dose which has killed is ½ drachm. A middle-aged man died in three-quarters of an hour from 3½ ounces of the acid (Rapp). Again, death may result months or years afterward from the effects of the poison.

If the acid be spilled, upon the skin brown spots may appear, or the color of clothing may be changed to red or yellow, or wholly discharged; if the goods be black, a moist, reddish-brown stain is seen.

Medical Uses and Dosage.—Externally, sulphuric acid has been used as a caustic, in *ulcers* and *malignant growths*, combined with enough saffron or sulphate of zinc to form a paste that will not spread beyond the part to which it is applied. It has been used in *entropion* and *ectropion*, to cicatrize the palpebral tissues in such a manner as to reverse the direction of growth. It is sometimes used in the form of ointment. As an internal remedy, it is only used in a diluted form. Diluted sulphuric acid is an excellent tonic, exciting the appetite, promoting digestion, quenching thirst, and checking fermentation in the stomach, and is therefore used with success in morbid acidity, debility, and relaxation of the stomach. As an astringent, it is used in *hemorrhages* of a passive character, *diarrhœa*, *chronic dysentery*, *Asiatic cholera*, etc. As a refrigerant, it is very useful in checking the perspiration in *hectic fever*; and forms a pleasant acid drink, when sufficiently diluted with water, in *continued fevers*, and during recovery from exhausting diseases; as an antiseptic, it is beneficial in putrid febrile diseases. It is an effectual remedy in *lead poisoning* or *painter's colic*, as are all of the soluble sulphates. As a remedy for *colliquative sweating*, it is probably one of the best we possess. For this use the aromatic acid is generally preferred. As a diuretic, it may be used in *dropsies*, and some forms of *fever*, but its use should not be continued too long, as it is apt to cause griping and looseness. It has likewise been advantageously exhibited in some *cutaneous diseases*, *phosphatic* *calculous affections*, *dyspepsia*, etc. Added to gargles, it will be found of service in *ulceration of the throat and mouth*, *profuse salivation*, etc.; and may be used in the form of a wash in *indolent ulcers*, and several *diseases of the skin*. The dose of the strong acid is 1 or 2 drops largely diluted (water fl℥vj); of the diluted acid 5 to 30 drops, well diluted in about 4 fluid ounces of water. Alkaline washes should follow to protect the teeth.

Specific Indications and Uses.—The deep-red tongue; diarrhœa, with deep-red tongue and gastric debility; colliquative sweats, with marked debility.

ACIDUM SULPHURICUM AROMATICUM (U. S. P.)—AROMATIC SULPHURIC ACID.

SYNONYMS: *Elixir of vitriol*, *Elixir vitrioli Mynsichti*, *Tinctura aromatica acida*, *Mynsicht's elixir.*

Preparation.—Sulphuric acid, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; tincture of ginger, fifty cubic centimeters (50 Cc.) [1 fl℥, 331 ♏]; oil of cinnamon, one cubic centimeter (1 Cc.) [16 ♏]; alcohol, a sufficient quantity. To make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Add the sulphuric acid gradually and with great caution to seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏] of alcohol, and allow the mixture to cool. Then add to it the tincture of ginger and the oil of cinnamon, and afterward enough alcohol to make the whole measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Keep the product in glass-stoppered bottles (*U. S. P.*).

Description.—This forms a pleasantly aromatic, acid preparation, having a pale-yellow color. "Aromatic sulphuric acid contains about 20 per cent, by weight, of official sulphuric acid, partly in form of ethyl-sulphuric acid. Specific gravity, about 0.939 at 15° C. (59° F.). If 4.89 Gm. of aromatic sulphuric acid be mixed in a small flask with 15 Cc. of water and boiled for several minutes (so as to decompose the ethyl-sulphuric acid), and the liquid be then allowed to cool, it should require, for complete neutralization, about 18.5 Cc. of normal potassium hydrate V.S. (each Cc. corresponding to 1 per cent of absolute or about 1.08 per cent of official sulphuric acid), phenolphtalein being used as indicator"—(*U. S. P.*) The sulphovinic acid (ethyl-sulphuric acid) developed in this preparation gradually increases as the product becomes old. The corresponding British preparation contains only a little over 12 per cent of sulphuric acid, and has a density of 0.911.

Medical Uses and Dosage.—This acid mixture possesses the same properties as diluted sulphuric acid, for which it is preferable, and generally substituted for internal administration. It is particularly applicable in *colliquative sweating*, and in *gastric derangements*. It may be given in doses of 5 to 30 drops, diluted with about 4 fluid ounces of water, and repeated 3 or 4 times a day. The teeth may be protected from the action of the acid, by taking it through a glass tube and employing thereafter an alkaline wash.

Specific Indications and Uses.—The deep-red tongue; diarrhœa, with the deep-red tongue and gastric debility; colliquative sweats, with marked debility.

ACIDUM SULPHUROSUM (U. S. P.)—SULPHUROUS ACID.

FORMULA: SO_2. MOLECULAR WEIGHT: 63.9.

SYNONYMS: *Sulphur dioxide*, *Sulphurous anhydride.*

"A liquid composed of not less than 6.4 per cent, by weight, of sulphurous acid gas (sulphur dioxide, $SO_2 = 63.9$), and not more than 93.6 per cent of water" —(*U. S. P.*).

History and Source.—The ancient Greeks and Romans were acquainted with the characteristic bleaching and disinfecting properties of sulphur fumes, and, according to Pliny, they were employed for purifying fabrics. Stahl, in 1697, differentiated the dioxide from oil of vitriol, and in 1775, sulphur dioxide was prepared pure, and investigated by Priestly (Roscoe and Schorlemmer). It exists in some mineral springs, in volcanic gases, and is formed whenever sulphur is burned in the atmosphere. Medicinal sulphurous acid, is a solution of sulphur dioxide in water, and has the formula, H_2SO_3.

Preparation.—On a small scale, sulphurous acid is obtained either by acting upon sodium sulphite with diluted sulphuric acid, or reducing sulphuric acid by heating with copper turnings, or with sulphur, or more generally with charcoal; in the latter case the following reaction takes place: $2SO_4H_2+C=CO_2+2H_2O+2SO_2$. The process indicated as follows by the *U. S. P.* is representative:

"Sulphuric acid, eighty cubic centimeters (80 Cc.) [2 fl℥, 338 ♏]; charcoal, in coarse powder, twenty grammes (20 Gm.) [309 grs.]; distilled water (1000 Cc.) [33 fl℥, 391 ♏]. Introduce the charcoal into a glass flask having a capacity of about five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; add the acid, and mix them well. Connect the flask, by means of suitable glass tubing, with a wash-bottle having a capacity of about two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏], which is filled to about one-third of its height with water. Through the stopper of the wash-bottle pass a safety-tube, which should reach nearly to the bottom of the bottle, and connect the latter, by means of glass tubing, with a bottle having a capacity of about fifteen hundred cubic centimeters (1500 Cc.) [about 50 fl℥], and containing one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of distilled water deprived of air by being boiled shortly before use. The tube should dip about 25 Mm. below the surface of the distilled water. By means of a second tube, connect this bottle with another containing a dilute solution of sodium carbonate, to absorb any gas which may not be retained by the distilled water. Having ascertained that all the connections are air-tight, apply a moderate heat to the flask containing the sulphuric acid and charcoal, until the evolution of gas has nearly ceased, and during the passage of the gas keep the bottle containing the distilled water at or below 10° C. (50° F.) by surrounding it with cold water or ice. Finally, pour the sulphurous acid into dark, amber-colored, glass-stoppered bottles, and keep them in a cool place, protected from light"—(*U. S. P.*).

In the preparation of sulphurous acid on a somewhat larger scale, Prof. J. U. Lloyd has, to great advantage, replaced the glass apparatus by a cast-iron retort of about 2 gallons capacity.

Description and Tests.—I. SULPHUROUS ANHYDRIDE.—Sulphurous acid gas is colorless, irrespirable, having the odor of burning sulphur, and an acid taste. It is very heavy, having the specific gravity 2.2112, forms an anhydrous, limpid liquid at —10° C. (14° F.), and at a very low temperature it solidifies. Respired in a concentrated form, it proves fatal to life; if diluted, it causes cough and headache. It is highly destructive to all animals. Its reaction in aqueous solution is strongly acid. It extinguishes combustibles in a state of flame, and in case of burning soot in a chimney, a handful of sulphur thrown into the fire will promptly extinguish it if the draft be closed. It bleaches many vegetable and animal colors, and its vapor, from burning sulphur, is used to whiten straw, bleach silk, woolen goods, and isinglass—in fact, is used for bleaching where chlorine can not be utilized or would be injurious. Brewers use a solution of sulphurous acid to cleanse casks that have been once used, and farmers make common use of the fumes of burning sulphur in purifying cider barrels. It is sometimes employed for the preservation of meats and canned fruits. It will remove fruit stains, and is employed by the pharmacist to bleach sponges. In combination with bases, its aqueous solution gives rise to the line of salts known as the sulphites. When dry, it shows no affinity for oxygen, but in contact with a little water it slowly combines with that gas, forming sulphuric acid.

II. SULPHUROUS ACID.—Sulphurous acid of the *U. S. P.* contains 6.4 per cent of absolute acid. It is "a colorless liquid, of the characteristic odor of burning sulphur, and of a very acid, sulphurous taste. Specific gravity not less than 1.035 at 15° C. (59° F.). By heat it is completely volatilized. Litmus paper moistened with the acid is first reddened and afterwards bleached"—(*U. S. P.*).

"On gently heating a few Cc. of the acid in a test-tube, the gas evolved will blacken a strip of paper moistened with mercurous nitrate T.S., but will not affect one moistened with lead acetate T.S. On mixing in a test-tube 1 Cc. of sulphurous acid with 5 Cc. of diluted hydrochloric acid, and adding a small piece of pure zinc, hydrogen sulphide gas will be evolved, which will blacken a strip of paper moistened with lead acetate T.S. If to 10 Cc. of sulphurous acid there be added 1 Cc. of diluted hydrochloric acid, and afterwards 1 Cc. of barium chloride T.S., not more than a very slight turbidity should be produced (limit of sulphuric acid). If 2 Gm. of sulphurous acid be diluted with 25 Cc. of distilled water and a little starch T.S. be added, at least 40 Cc. of decinormal iodine V.S. should be required before a permanent blue tint is developed (each Cc. corresponding to 0.16 per cent of sulphur dioxide)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Organic matter is energetically attacked by this acid, which has a selective affinity for oxygen. Fungi, bacteriæ, and other low forms of life, are destroyed by it. Pronounced irritation of the glottis is produced by inhaling sulphur dioxide, and the sensation of suffocation produced is intense. The air passages may be violently inflamed by large amounts of the gas. Fatal cases from the burning of coal giving off a large amount of this gas, present a cold surface, livid countenance, purple lips, hands, and nails; short, quick breathing; quick, feeble, and small pulse; fixation of the pupils, and complete insensibility. Congestion of the brain, heart, and lungs is, as a rule, the chief post-mortem feature, like one who has been hanged (see Taylor).

Sulphurous acid was introduced into medicine owing to its destructive influence upon inferior organic growths, whether animal or vegetable, and from its apparent azymotic property. It has been found very useful in *typhoid* or *enteric* and *remittent fevers*, *scarlet fever*, *smallpox*, *measles*, *puerperal* and *surgical fevers*, and in *dysentery* and *pneumonia*, both of typhoid type, in *sarcinæ ventriculi*, and in *pyrosis*, checking the excessive secretion, stopping the vomiting, and lessening epigastric pain. Dr. H. Lawson has found the fluid of pyrosis to contain sarcinæ, torulæ, huge clusters of leptothrix, and myriads of vibriones and bacteriæ, which, by their presence, keep up the irritation causing pyrosis; the sulphurous acid checks these unusual processes by its parasiticidal properties. He advised from half a drachm to a drachm, 3 times a day, shortly before meals, largely diluted with distilled water. Yeasty fermentation calls for it. The sulphites of sodium or magnesium produce similar results, as they become decomposed when in the stomach, and give out sulphurous acid.

To be of service in the foregoing disorders, as well as in those to follow, this agent must be specifically applied. The cases for it are those calling generally for acid medication; though it is not used as an acid, for its acid properties are feeble. Yet the general state of the system tends toward excessive alkalinity (redness), while, on the contrary, the alkaline sulphites are indicated in excessive acidity (pallid tongue and membranes). The characteristic condition for sulphurous acid, is one of a low state, with normal or increased redness of the tongue and membranes. The tissues are enfeebled, full and relaxed, and appear to have lost vitality; the pulse large and empty, the sensation under the finger being that of a large-calibred vessel with a small stream of blood. The secretions are nasty, dirty, and exhale, as well as the breath, a peculiar, sweetish, mawkish odor. The membranes are reddened and dirty, or muddy in color. The tongue is characteristic, being coated, over red, with a glutinous, nasty, yellowish-brown, or the coating may be transparent; and, again, it may appear as if fecal matter had been rubbed upon it. In later stages a moist, glutinous, brownish fur may line the center of the organ. Occasionally the tongue is slick and shining, like a piece of raw beef. Dirty sordes upon the teeth and lips; and the saliva is increased in quantity, viscid, and mawkish. When externally indicated, as in *erysipelas* and like conditions, the tissues are deep-red, and appear to have lost vitality. The erysipelatous redness blanches more or less as the disease progresses, "sometimes in the center, sometimes at the border, sometimes in the deep structures, you seem to be looking through the superficial redness" (Scudder, *Spec. Diag.*, 90). *Wounds* and *abrasions* seem to show a tendency to slough, and are bathed in dirty, sticky, unhealthy secretions. Added to these a depraved state with *yeasty vomiting*, and you have the uses for one of our most important antiseptics.

Sulphurous acid has been largely employed as an external application in all *cutaneous parasitic affections*, and in which, before its application, the scabs have been removed, so as to have the diseased surface directly exposed to the agent. For this purpose it may be applied pure, or diluted with glycerin or water, of the required strength. The use of glycerin, however, should be guarded, as it often acts as an irritant to the skin, as well as doing injury by abstracting water from the tissues, leaving them hard and dry. *Tinea tonsurans*, *versicolor*, and *favosa*, *urticaria*, *scabies*, *ringworm*, and *purpura*, are successfully treated with it. As a wash, or in the form of spray, it has been found effectual in *thrush*, *diphtheria* (with dusky coloration of membranes), *follicular pharyngitis*, *clergyman's sore throat*, *chronic irritation of the larynx and vocal cords*, *weakness* or *loss of voice* from the preceding cause, *chronic bronchitis*, *pertussis*, *asthma*, *wounds*, and *ulcers*. In these conditions it should be used internally also. *Mucous patches*, *tonsillitis*, and *mercurial stomatitis*, when having the characteristic indication, yield promptly to this acid. As an application to *sloughing wounds* and *ulcers*, with sticky, glutinous secretion, it is of marked value. Give it internally at the same time.

Cures have been effected in several cases of extensive *syphilitic ulceration* of the throat and posterior nares, by the spray, repeated 2 or 3 times a day, of sulphurous acid, used of official strength, or diluted with an equal volume of water. It is equal, if not superior to carbolic acid, in efficiency, besides being free from the objections to the latter, as, its disgusting odor and its powerful, irritant, action. Dr. James Dewar has found sulphur dioxide very efficacious in *pleuropneumonia of cattle*, *chilblains*, *chapped hands*, *obstinate grease* of the heels in horses, *ringworm*, *molluscum*, *mange*, *lice*, *hospital gangrene*, and as a disinfectant; having in all these difficulties made use of it in the form of sulphur fumigation, paying proper attention to ventilation of the apartment in which the cattle or persons are exposed to the vapor. He has even met with unexpected success in a case of supposed *phthisis*, with which several other eminent medical men were acquainted. We can not, however, subscribe to its alleged curative action in the last-named disease, though we believe it to be valuable in mitigating many of the unpleasant symptoms, and particularly in overcoming the sweetish, mawkish odor of the sputa and breath. As a decalcifying agent to assist in the removal of carious fragments from the aural canal and tympanum, it has found some favor. Dose, from 10 to 60 drops, well diluted. The acid must be fresh, and not remain long in contact with water. Dispense it in bulk.

Specific Indications and Uses.—Full, relaxed, dirty-looking tissues, with deep redness and sticky, unhealthy discharges; sweetish, mawkish odor of breath and discharges; saliva increased and viscid: tongue full, broad, atonic, normally red, with glutinous coat, either transparent or dirty-brownish, with effaced papillæ; unhealthy, viscid wounds and ulcers; gastric derangements with yeasty fermentation. All the conditions are those of sepsis and debility.

ACIDUM TANNICUM (U. S. P.)—TANNIC ACID.

FORMULA: $HC_{14}H_9O_9$. MOLECULAR WEIGHT: 321.22.

SYNONYMS: *Gallotannic acid*, *Digallic acid*, *Tannin*, *Tanninum*.

"An organic acid obtained from nutgall"—(*U. S. P.*).

Source.—Tannin is a name applied to vegetable substances possessing acid properties and having an astringent taste, and which produce with iron salts a dark precipitate or solution, and precipitate albumen and gelatin. The tannin under consideration is produced from nutgalls, and to distinguish it from other tannins, is known as gallotannic or digallic acid. Tannic acid may be obtained from nutgalls (excrescence on *Quercus lusitanica*, Lamarck, *var. infectoria*, Nat. Ord. *Cupuliferæ*, *U. S. P.*), from the leaves of the *Rhus Coriaria*, Linné, from some kinds of acorn cups, and from Japanese and Chinese galls. Allied tannic acids are also found in catechu, coffee, fustic, quercitron, pomegranate, kino, cinchona, tea, the oak, willow, elm, horse-chestnut, plum, pear, sumach, whortleberry, etc., in each instance possessing nearly the same properties, though their chemical composition is different. Some of them form a dark-green color with the salts of iron, and a few form a gray color. Gallotannic acid produces a dark-blue, or bluish-black precipitate with ferric salts. Tannic acid was distinguished as an individual compound by Deyeux and Seguin, in 1793 and 1795, respectively. Gallotannic acid was found by Schiff, in 1871, to be an anhydrid of gallic acid, having the constitutional formula: $CO_2H.C_6H_2(OH)_2O.COC_6H_2(OH)_3$.

Preparation.—Allow sulphuric ether to percolate through a suitable quantity of powdered galls contained in a glass percolator, the lower end of which is loosely closed with a pellet of cotton. The liquor obtained in the receiver separates into two parts, and the ether must be allowed to percolate through the galls until the lower stratum of liquid in the receiver no longer increases. Pour off the upper layer, and evaporate the lower portion with a moderate heat, to dryness.

It is stated that a much larger quantity of tannic acid may be obtained by employing a mixture of 16 parts of ether and 1 part of alcohol. The percolated liquid separates into two layers. The lower one contains the tannic acid, which may be obtained perfectly pure on evaporation; the upper layer contains the gallic acid, coloring matter, and some tannic acid. The tannic acid in the upper layer may be obtained by evaporating the liquid to dryness, treating the residue with pure ether, until the lower of the two layers, into which the liquid separates, no longer presents a green color; and then separating it, adding, if necessary, a little alcohol, and evaporating.

Description and Tests.—"A light-yellowish, amorphous powder, usually cohering in form of glistening scales or spongy masses; odorless, or having a faint, characteristic odor, and a strongly astringent taste; gradually turning darker when exposed to air and light. Soluble at 15° C. (59° F.) in about 1 part of water, and in 0.6 part of alcohol; very soluble in boiling water, and in boiling alcohol; also in about 1 part of glycerin, with the intervention of a moderate heat; freely soluble in diluted alcohol, sparingly in absolute alcohol; almost insoluble in absolute ether, chloroform, benzol, or benzin. When heated on platinum foil, the acid is gradually consumed without leaving more than 0.2 per cent of ash. Tannic acid has an acid reaction upon litmus paper"—(*U. S. P.*).

The watery solution, exposed to the air, absorbs oxygen, and is transformed into carbonic acid gas, which escapes, leaving behind gallic and ellagic acids. Oils do not dissolve it. Tannic acid combines with a solution of animal gelatin, forming a white, curdy, insoluble substance, the tannate of gelatin; a piece of prepared skin introduced into a solution of tannic acid, absorbs the acid and is converted into leather. With the per-salts of iron, tannic acid and its salts strike a deep-blue, nearly black color, which is a tannate of iron, and the principal ingredient of ordinary ink. Ink stains are gallo-tannates of iron, and are readily removable by oxalic and citric acids, owing to the solubility of the iron basis. When potassium hydroxide is added in excess to a solution of tannic acid, tannoxylic or rubitannic acid is formed; if the mixture be boiled, instead of exposed to the air, tannomelanic or tannohumic acid is formed, a bibasic, dark, humus-like powder. Concentrated sulphuric acid dissolves the dry tannins, forming yellow solutions which, when heated, become deep-red, owing to the formation of rufi-gallic and meta-gallic acids. Potassium bichromate causes brown precipitates with the majority, if not all, of the tannins (Trimble, *On Tannins*). Tannic acid precipitates most metallic oxides from the solution of their salts; is more or less completely precipitated from its solution by mineral acids, and gives, with those acids, compounds soluble in pure water. If tannic acid be treated with oxidizing bodies, as with nitric acid, chromic acid, chlorine, bromine, or the higher oxides, it is completely destroyed, under production of formic and oxalic acids. Acetate of lead added to a solution of tannic acid, produces a white precipitate; tartar emetic gives a white precipitate, of a gelatinous character. When given internally, tannic acid will be found, when passed in the urine, to have changed into gallic acid. There is a substance formed in white wines, called glaïadine, which renders them turbid and disposed to mucous fermentation; a solution of tannic acid will arrest this by coagulating the above-named substance.

The *U. S. P.* gives the following tests: "The addition of a small quantity of ferric chloride T.S. to an aqueous solution of the acid, produces a bluish-black color or precipitate. On adding to an aqueous solution (1 in 100) of tannic acid a small quantity of calcium hydrate T.S., a pale, bluish-white, flocculent precipitate is produced which is not dissolved on shaking (difference from gallic acid), and which becomes more copious and of a deeper blue by the addition of a moderate excess of calcium hydrate T.S., while a large excess of the latter imparts a pale-pinkish tint to the solution. The aqueous solution of the acid produces precipitates with most alkaloids and bitter principles, and with test solutions of gelatin, albumen, and starch (distinction from gallic acid). On dissolving 2 Gm. of tannic acid in 10 Cc. of boiling water, and allowing the liquid to cool, no turbidity should be produced on diluting 5 Cc. of the solution with 10 Cc. of alcohol (absence of gum or dextrin), or with 10 Cc. of water (absence of resin)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Tannic acid is a pure astringent. It has a bitter, astringent taste, and a constringing action upon mucous tissues. As a general rule it does not derange the stomach, yet it precipitates pepsin from the gastric secretions. It generally produces constipation, by contracting the intestinal vessels, thus diminishing the secretions and retarding peristaltic action. It sometimes, and especially when long given, occasions gastric and intestinal pain, febrile phenomena, with thirst and eructations of gas, while the tongue is coated, and defecation tenesmic. It powerfully coagulates blood and albumen, and enters into the blood in the form of gallic acid. It probably controls hemorrhage by acting upon the vascular coats. Erythema, dyspnœa, and a cyanotic condition have been produced by it.

In view of its astringent power, tannic acid is very valuable in *gastro-intestinal disorders*, with undue acid, watery, or mucoid secretions, and accompanied with flatulence. In the various forms of *non-irritative diarrhœa*, without fever or inflammation, it is of marked utility. *Chronic dysentery* is asserted to be benefited by it. Tannic acid should never be given when there is fever or active inflammation. The *diarrhœa* and *colliquative sweats of phthisis* are controlled by it, the febrile condition here, if present, not contraindicating its use. It is effectual in *uterine* and other *passive hemorrhages*, and as a wash or injection to remove chronic mucous discharges, as in *bronchial catarrh*, *gonorrhœa*, *gleet*, *leucorrhœa*, etc. "Use it in *hemorrhage*, from abortion, or any passive uterine hemorrhage, with pain and nervous disturbance. Take 30 grains each, of tannic acid and Dover's powder, and divide into 5 or 10 powders, and let 1 be taken every hour or two until the bleeding is arrested. This will check the flow, provided there is no organic lesion" (Locke, *Syl. of Mat. Med.*). In this manner it is of much value in *menorrhagia*. *Hematuria*, *hematemesis*, and *hemoptysis* (by spray) are benefited if the blood is small in amount. If the hemorrhage be active in the latter case, the agent is too slow in producing its effects. It has likewise been recommended in *diabetes*, combined with opium, and to arrest excessive perspiration; also, in conjunction with morphine, in *Asiatic cholera*. Externally, it has been successfully used in *excoriations*, *prolapsus ani*, *piles*, *fissure of the anus or rectum*, *sore nipples*, *phagedenic ulcers*, *aphthous ulceration of the mouth*, *sore throat*, *severe salivation*, and in *toothache*, in solution with ether. Applied to *nasal polypi*, it is stated to have produced a rapid disappearance of the abnormal growths. In the form of ointment, it will frequently prove effectual in curing *vaginal leucorrhœa*, being introduced into the vagina on lint or cotton, and allowed to remain there, changing it every 3, 4, or 5 hours. In solution or powder, in the form of spray passed upon the affected parts, it gradually overcomes *chronic mucous irritation* or *congestion*, and has been beneficially applied in *chronic nasal*, *faucial*, *pharyngeal* and *laryngeal mucous affections*. Dissolved in 3 parts of mucilage, it has effected cures in *chronic granular conjunctivitis*, *corneal ulceration*, and other affections of the eye. It may be used in *ophthalmia neonatorum*, with granular conjunctiva (1 part in 10 of water); and in *purulent conjunctivitis*, with but little swelling and small quantity of secretion, use a wash of from 2 to 10 grains to 1 ounce of distilled water. In the early stage of *trachoma*, when there is slight roughness of the conjunctiva, the beginning of granulation, with injected and clouded upper part of the cornea, a glycerole (5 grs. to 1 fl℥) dropped into the eye in 2-drop doses will allay the gritty sensation. In advanced trachoma, with soft, pasty granulations, it may be used in connection with gallic or boric acids (R Boric acid ʒiij; tannic acid ʒi; R Gallic acid ʒi; tannic acid ʒiij). It is of little value to destroy *aural polypi*, and when used in *suppurative otitis media*, as it sometimes is, it is objectionable in that hardened masses, difficult of removal, are formed. Its solution in glycerin is a powerful styptic. It may be employed in the form of a wash, by adding 5 grains to a fluid ounce of water; or in ointment, 1 part of the acid to 10 or 15 of lard. It is a valuable remedy, the only disadvantage being its tendency to produce constipation, which may be avoided by the addition of a small quantity of podophyllum resin, in cases where this resin is not contraindicated.

The glycerole of tannin is very efficient in *sores* occuring from the use of false teeth; and in *ingrowing toe-nail*, with fungous granulations, the pure acid is especially useful. It forms a good dressing for *burns*. Several cases of *cholera* in the collapsed stage have been cured by our physicians, by doses of 10 or 15 grains of tannic acid, repeated every 10 or 15 minutes, until the discharges ceased; and continuing it afterward at longer intervals, with other appropriate treatment. Tannic acid, as an internal astringent, sometimes leaves the tissues upon which it acts harsh and dry. Dr. Chausarel has proved that tannic acid is the best antidote against *poisonous fungi*, or *mushrooms*, etc.; 30 or 40 grains of tannic acid, dissolved in a pint and a half of water, may be taken in small glassful doses every 5 minutes; if too much time has not elapsed an emetic may be first administered. Tannic acid is one of the best antidotes against *poisoning by strychnine*, forming an insoluble tannate of strychnine; it may be given freely. Dose of tannic acid, from half a grain to 10 grains. Suppositories, consisting each of 12 or 15 grains of butter of cacao, and 3 to 5 grains of tannic acid, are valuable in some rectal and vaginal diseases, as *anal prolapsus, hemorrhoids, abrasion of the vaginal epithelium, leucorrhœa*, etc.

Specific Indications and Uses.—Relaxed states of the gastro-intestinal tract, with excessive secretions, and no fever or inflammation; soft, pasty or fungoid granulations; passive hemorrhages; leucorrhœa with vaginal relaxation.

ACIDUM TARTARICUM (U. S. P.)—TARTARIC ACID.

FORMULA: $H_2C_4H_4O_6$. MOLECULAR WEIGHT: 149.64.

SYNONYMS: *Dextro-tartaric acid, Dioxysuccinic acid, Sal essentiali tartari.*

"An organic acid usually prepared from argols"—(*U. S. P.*).

Source and History.—Scheele first prepared this acid in 1769. Retzius, in 1770, produced it in crystalline condition. Tartaric acid is a constituent of grape juice in the form of an acid tartrate of potassium, and is also contained in many other plants, as in the juice of the pineapple, tamarind, sorrel, mulberry, "sumach-bob," etc. The acid of commerce is produced almost exclusively from "*crude tartar*" or "*argols*," a refuse by-product in the manufacture of wines. Formerly the American market was chiefly supplied by European manufacturers, but at the present time nearly all of the acid consumed here is produced in the United States from *argols* shipped from European ports.

Preparation.—This acid is prepared somewhat similarly to citric acid, by forming tartrate of calcium and decomposing it by sulphuric acid; this is generally effected by adding an excess of carbonate of calcium to a solution of acid tartrate of potassium, which yields a precipitate of insoluble tartrate of calcium. The remaining salt in solution (neutral potassium tartrate), is then treated with calcium chloride, which decomposes it with the production of soluble potassium chloride and insoluble calcium tartrate, which latter product is then collected, thoroughly washed, and acted upon by sulphuric acid, which sets the tartaric acid free, and forms a precipitate of sulphate of calcium. To obtain the acid pure, it is evaporated, crystallized, redissolved in water, strained, and recrystallized three or four times. When prepared on an extensive scale, sulphate of calcium is substituted for chloride of calcium on account of the cheapness of the former. The colored crystals are treated with charcoal and recrystallized. The finest crystals are produced when there is a slight excess of sulphuric acid.

Description.—Tartaric acid occurs in "colorless, translucent, monoclinic prisms, or crystalline crusts, or a white powder, odorless, having a purely acid taste, and permanent in the air. Soluble at 15° C. (59° F.), in about 0.8 part of water, and in 2.5 parts of alcohol; in about 0.5 part of boiling water, and in about 0.2 part of boiling alcohol; also in 250 parts of ether; nearly insoluble in chloroform, benzol, or benzin. When heated for some time at 100° C. (212° F.), the powdered crystals do not suffer a sensible loss of weight. At 135° C. (275° F.), the acid melts. At higher temperatures it is gradually decomposed, emitting the odor of burning sugar, and is finally consumed without leaving more than 0.05 per cent of ash. Tartaric acid has an acid reaction upon litmus paper"—(*U. S. P.*).

Its aqueous solution molds on exposure, yielding acetic and butyracetic acids. Fused with hydroxide of potassium, it decomposes into acetic and oxalic acids and water. When gently heated, the crystals of tartaric acid acquire electrical polarity equal to that of tourmaline. Tartaric acid possesses in a remarkable degree the property of turning the plane of polarized light to the right, which is increased by warming the substance, as well as by combination with bases. Nitric acid immediately decomposes it into oxalic and carbonic acids; chlorine does not decompose it. Tartaric acid gives rise to tartrates of two kinds, the neutral and acid tartrates; with caustic potash and ammonia it forms neutral salts, easily soluble, and acid salts not easily soluble. When heated with sulphuric acid they are readily charred. Tartaric acid may be reduced to succinic acid by saturating its concentrated aqueous solution with hydriodic acid, sealing in a strong glass tube, and heating it for 6 or 8 hours, not to exceed the temperature of 120° C. (248° F.). Tartaric acid may be known by its sour solution, which gives white precipitates with solutions of caustic lime, baryta, strontia, and acetate of lead, the precipitated tartrates being soluble in excess of acid. Ammonium chloride dissolves the precipitate produced by lime-water. Sulphate of calcium gives no precipitate; a solution of chloride of platinum causes a black precipitate of metallic platinum. Most of the commercial tartaric acid is in the form of a white, crystalline powder.

By the researches of M. Pasteur, the existence of four isomers of tartaric acid (dextro-tartaric) was established, all having the same formula, $H_2C_4H_4O_6$, but differing principally in their behavior towards polarized light. These isomers are: (1) racemic, (2) lævo-tartaric, (3) meso-tartaric, and (4) meta-tartaric acids.

1. *Racemic acid* (*para-tartaric* or *uvic acid*), occurs in the mother liquors obtained in the making of cream of tartar. It is optically inactive, being a compound of equal amounts of dextro- and lævo-tartaric acids, and has been resolved into its constituents by preparing a supersaturated solution of its sodium-ammonium salt and dropping into the fluid a crystal of the sodium-ammonium salt of either the dextro- or the lævo-rotatory acid, whereby this form of salt will crystallize out while the other form remains in solution. Mineral acids will then liberate the respective free tartaric acids from these salts. Racemic acid is best obtained by heating ordinary tartaric acid with 0.1 part of water, to 175° C. (347° F.), whereby it is completely converted into meso-tartaric and racemic acids. It crystallizes more readily than tartaric acid, into efflorescent, triclinic prisms, containing 1 molecule of water of crystallization. Its acid potassium salt is by far more soluble than the salt of dextro-tartaric acid (cream of tartar); its calcium salt is distinguished by its being insoluble in acetic acid.

2. *Lævo-tartaric acid*, turns the plane of polarized light to the left, and has otherwise the general properties of the dextro-acid.

3. *Meso-tartaric acid*, is formed when dextro-tartaric acid is heated to 165° C. (329° F.), with about one-eighth its quantity of water, for about 2 hours. It is optically inactive and can not be resolved into dextro- and lævo-tartaric acids.

4. *Meta-tartaric acid*, is formed when dextro-tartaric acid is heated till it fuses, *i. e.*, to 130° C. (266° F.). It is also dextro-rotatory, but differs from ordinary tartaric acid mainly in its deliquescence and that of its salts.

Tests.—The *U. S. P.* directs the following tests for tartaric acid: "An aqueous solution (1 in 2) of the acid mixed with a strong solution (1 in 3) of potassium acetate yields a white, crystalline precipitate which is soluble in solutions of alkalies and in mineral acid, but insoluble in acetic acid. The aqueous solution (1 in 10) of the acid, acidulated with a few drops of hydrochloric acid, should remain unaffected by barium chloride T.S. (absence of sulphuric acid). Another portion of the aqueous solution (1 in 10) in which the free acid has been nearly, but not entirely, neutralized by ammonia, should not be affected by calcium sulphate T.S. (absence of and difference from oxalic and uvic acids). On supersaturating 10 Cc. of the aqueous solution (1 in 10) with ammonia water, no turbidity should be produced in the liquid by ammonium oxalate T.S. (absence of calcium), nor should the further addition of 1 drop of ammonium sulphide T.S. produce any dark coloration or precipitate (absence of iron, lead, copper, etc.). To neutralize

3.75 Gm. of tartaric acid should require 50 Cc. of potassium hydrate V.S. (each Cc. corresponding to 2 per cent of the pure acid), phenolphtalein being used as indicator"—*U. S. P.*

Action, Medical Uses, and Dosage.—Tartaric acid in large doses is an unsafe agent, causing gastro-intestinal inflammation and death. The symptoms in man from 1 ounce largely diluted, were intense, burning pain in the fauces and stomach, persistent vomiting, and death in nine days, the effects being those of a corrosive poison.

Tartaric acid is refrigerant, antiseptic, and antiscorbutic. It is used as a drink in *febrile* or *inflammatory diseases*, forming a cooling, refreshing, and agreeable acidulous draught. It is less costly than citric acid, and may be used instead of this acid to form an artificial lemonade. Tartaric acid enters into the composition of *Seidlitz*, as well as of *soda powders*. A colorless solution of sulphate of quinine has long been employed by physicians; it may be made by adding equal parts of tartaric acid and sulphate of quinine to as much water as may be desired. The dose of tartaric acid is from 10 to 30 grains dissolved in water or syrup.

Related Preparation.—ACIDUM TARTARICUM SACCHARATUM (N. F.), *Saccharated tartaric acid. Formulary number*, 8: "Tartaric acid (*U. S. P.*), in very fine powder, six hundred and seventy-five grammes (675 Gm.) [1 lb. av., 7 ozs., 354 grs.]; sugar, in very fine powder, three hundred and twenty-five grammes (325 Gm.) [11 ozs. av., 203 grs.]. Triturate the powders together until intimately mixed, and preserve the product in well-stoppered bottles.

"*Note.*—This saccharate, when dissolved in water with an equal weight of saccharated sodium bicarbonate (F. 341), will form a neutral solution, and it is introduced into the formulary for the convenient preparation of effervescent powders (F. 319). This saccharate contains 67.5 per cent of tartaric acid"—(*Nat. Form.*).

ACIDUM VALERIANICUM.—VALERIANIC ACID.

FORMULA: $HC_5H_9O_2$. MOLECULAR WEIGHT: 101.77.

SYNONYMS: *Valeric acid, Isopentoic acid, Isopropyl-acetic acid, Acidum valericum.*

Source and History.—Chevreul, in 1817, first obtained this acid from the oil of the dolphin (*Delphinus globiceps*), and named it *delphinic acid*. An identical acid was afterward found in the *Valeriana officinalis*, after which the name delphinic acid was changed to valerianic acid. Besides being found in valerian, it exists in *Sambucus nigra, Anthemis nobilis, Artemisia Absinthium, Angelica archangelica, Viburnum opulus*, and other plants. Oxidized organic material yields it. The pure acid from valerian plant is seldom used in medicine, but in its stead an acid, prepared by the oxidation of fusel oil (amylic alcohol), when acted upon by sulphuric acid and potassium bichromate, is employed. So violent is the reaction, and so disagreeable the odor, that few care to make valerianic acid.

Preparation.—The *U. S. P.* (1870) directed to take coarsely-powdered sodium valerianate, 8 troy ounces; sulphuric acid and water, of each a sufficiency. Three fluid ounces of the water are first added to the valerianate, and subsequently 3½ troy ounces of the sulphuric acid, and all mixed thoroughly. After standing, an oily acid layer rises to the top, which must be removed and agitated with small quantities of sulphuric acid until its density is below 0.950. This is put into a retort, distilled almost to dryness, rejecting that distillate having a density above 0.940. The remainder is kept for use. The rejected distillate may be redistilled, yielding an acid sufficiently pure to use in preparing the valerianates.

Description.—Valerianic acid is a thin, colorless, inflammable, oily fluid, of an intensely disagreeable and offensive odor, and has an unpleasant, acrid, sour, burning taste. It has a strong acid reaction. With alkalies it forms valerianates. With alcohol, in which it is freely soluble, it forms an almost odorless solution, but if water be brought into contact with it, it instantly regains its disagreeable odor. It is freely soluble in water, chloroform, ether, and concentrated acetic acid. With the volatile oils and carbon disulphide it forms turbid mixtures. Camphor and some resins are soluble in it. Most of its salts are permanent and odorless when dry, but added to water (in which most of them are soluble) they develop the rank odor of the acid.

Action and Medical Uses.—Experimentation upon animals showed Reissner that this acid was strongly irritant to the skin and membranes, and that it coagulated milk, albumen, and the serum of the blood. Quickened and enfeebled respiratory and cardiac action were noticed, with marked debility and paralysis of the extremities, followed by spasm and death. If death were slow, the kidneys were found congested, the urine bloody and turbid, and the bowels inflamed; if death resulted quickly, the gastric interior was pallid. This acid is only used in medicine in combination with bases forming valerianates.

ACONITINA.—ACONITINE.

Formula: $C_{34}H_{47}NO_{11}$ (Freund and Beck). Molecular Weight: 643.55.
Synonyms: *Aconitia*, *Aconitinum*.

Preparation, History, and Chemical Composition.—Wright's process is as follows: Exhaust powdered aconite root with alcohol, in which has been dissolved 0.5 per cent of tartaric acid. Distill the alcohol to complete evaporation at a low heat or *in vacuo*. Dilute the extract so obtained with a like quantity of water, remove the oil and resin by filtration, add ether or petroleum naphtha to remove the remaining resin, and precipitate with excess of salt of tartar. Dissolve the precipitate in ether, mix again with petroleum naphtha and evaporate. This process will yield a crystalline aconitine, having, however, a small amount of adherent amorphous product, not wholly separated by the potassium carbonate. Other methods, in which sulphuric acid and ammonia water are chiefly employed, yield an amorphous product. The chemistry of aconite and aconitine has been the subject of much controversy. That the mineral acids produce the amorphous form, and that tartaric acid does not decompose aconitine, were first shown by Duquesnel, in 1872. Groves first obtained it in crystalline form. Wright (1875–1880) showed that aconitine could be resolved by heat or by saponification with an alkali into benzoic acid and *aconine* ($C_{26}H_{39}NO_{11}$), an amorphous body, identical with *acolyctine* and *napelline*, and having a bitter, non-acrid taste. Aconine dissolves freely in water, alcohol, and chloroform, but is nearly insoluble in ether. Wright assigned to aconitine the formula $C_{33}H_{43}NO_{12}$, and found its fusing point to be 183° C. (361.4° F.). Subsequently Dunstan and Ince, in 1891, gave it the formula $C_{33}H_{45}NO_{12}$; fusing point 186.5° C. (367.7° F.). In 1894 and 1895, Freund and Beck pronounced aconitine to be an acetyl-benzoyl derivative of aconine, establishing for the latter alkaloid the formula $C_{25}H_{41}NO_9$; hence, for the pure aconitine $C_{34}H_{47}NO_{11}$., having a fusing point at 197–198° C. (386.6–388.4° F.). The results obtained by Dr. Freund seem now to be generally adopted as correct. Commercial aconitine has repeatedly been shown to be of various degrees of strength, and is a mixture of the foregoing alkaloids, together with *pseudaconitine* ($C_{36}H_{49}NO_{12}$) and *picraconitine* ($C_{31}H_{45}NO_{10}$), the former being capable of conversion into *dimethyl-protocatechuic acid* (*veratric acid*) ($C_9H_{10}NO_4$) and *pseudaconine* ($C_{27}H_{41}NO_9$). [For a recent investigation in this direction, see Dohme, *Proc. Am. Ph. A.*, 1895, p. 206].

Description.—The pure alkaloid has a slightly bitter, but acrid, taste, and dissolves easily in alcohol, ether, chloroform, and benzol. That made according to the *British Pharmacopœia*, is a white, amorphous body, sparingly soluble in cold, more readily in hot water, and still more freely in ether and alcohol, but it is almost insoluble in benzin. It produces protracted numbness, preceded by tingling, when rubbed on the hands or skin. Pseudaconitine alone is often sold for crystalline aconitine. According to Dr. E. R. Squibb (*Ephemeris I.*, 135), no aconitine should be accepted of which $\frac{1}{800}$ grain dissolved in 1 fluid drachm of water, and held in the anterior portion of the mouth (first well rinsed) for 1 minute, which will not, within 15 minutes, produce a pronounced aconite sensation short of, but bordering on, numbness. Most of the commercial aconitine is now made by patented processes.

Action, Medical Uses, and Dosage.—The effects of this drug are those mentioned under aconite, though greatly intensified, as it is a much more powerful agent than the parent drug. The ointment or alcoholic solution, applied to the unbroken skin, produces tingling, prickling, and anæsthesia. Neither redness nor heat are observed, however, from such use. Upon broken skin, intense burning is felt, and when placed upon the ocular membranes violent irritation is produced. It should never be used as an internal agent, its effects being such that its employment, when the drug is pure, is too hazardous. Owing to the variability of the commercial product the dosage can not safely be regulated.

Dr. Turnbull introduced aconitine as an external agent in *neuralgia* and *rheumatism*, in the form of tincture or ointment. His ointment is composed of aconitine, 16 grains; olive oil, half a drachm; lard, an ounce. Mix. To be rubbed for several minutes over the affected part. The tincture is made by dissolving 8 grains of aconitine in 2 fluid ounces of alcohol. In using these preparations they should not be applied where the skin is broken or excoriated. Even as an external agent its use should be discouraged. When employed internally, as it has been by some physicians, the dose ranges from $\frac{1}{500}$ to $\frac{1}{90}$ grain; as a beginning dose not more than $\frac{1}{250}$ grain should be administered. We have known alarming symptoms to be produced by $\frac{1}{500}$ grain of aconitine.

ACONITUM (U. S. P.)—ACONITE.

The root and leaves of the *Aconitum napellus*, Linné. (*Aconitum vulgare*, De Candolle; *Aconitum variabile*, Hayne).

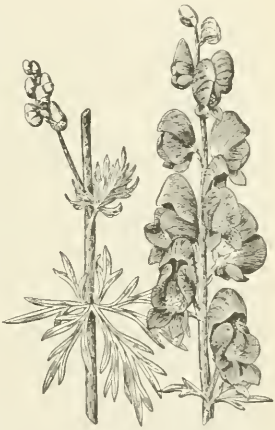
Nat. Ord.—Ranunculaceæ.

Common Names.—*Monkshood*, *Wolfsbane*.

Illustration: Bentley and Trimen, *Med. Plants*, 5, 6, 7.

Botanical Source.—Aconite plant is a perennial herb, having a simple stem (usually growing from 2 to 4, sometimes 8 feet high), and bearing palmately-lobed leaves; those low on the stalk being from 5 to 7-cleft, those higher 3 to 5-cleft. Each of these lobes is, again, from 3 to 5-parted. They are alternate, petiolate (the lower ones having long foot-stalks), and are deeply divided, and vary from 2 to 4 inches in diameter. Each lobe is toothed in such a manner that each tooth terminates in a lance-linear point. The leaves are stiff and somewhat smooth and coriaceous, the under surface being light, while the face of the leaf is of a bright, shining, green color. The flowers are large, attractive, and of a dark-purple or violet-blue hue (sometimes white) and are borne in a terminal raceme, with occasional clusters below, in the axils of the leaf stalks. The upper sepal is helmet-shaped and pointed, and the lateral sepals hairy on the inner surface. The fruit consists of from 3 to 5 capsular pods, containing numerous angular, corrugated seeds.

Fig. 2.



Aconitum napellus.

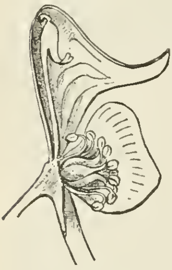
Description.—Aconitum (*U. S. P.*) *Aconite.* Aconiti radix.—The root is prolonged into a conical tap-root, tuberous, and though smaller, has some resemblance to the common horseradish root, for which it has been mistaken, and eaten with fatal consequences. At the top it seldom exceeds an inch in thickness, and is about 2 to 4 inches long. Externally, it is brown; internally white and fleshy. As found growing, there is usually a rhizome produced from a lateral bud from the tuber. At the extremity of this subterranean stem, another tuber, with a bud for the next year's plant, is developed. This second tuber, in the course of the year, develops a third tuber, so that when dug for commerce it is common to find at least two roots, connected by a short rhizome. Each root has several long, fleshy rootlets. The fresh root has a radish-like odor which is dissipated on drying. The dried root is thus described in the *U. S. P.*:

"From 10 to 20 Mm. ($\frac{2}{5}$ to $\frac{4}{5}$ inches) thick at the crown; conically contracted below; from 50 to 75 Mm. (2 to 3 inches) long, with scars or fragments of radicles; dark-brown externally, whitish internally; with a rather thick bark, the central axis about seven-rayed; without odor; taste at first sweetish, soon becoming acrid, and producing a sensation of tingling and numbness, which lasts for some time"—(*U. S. P.*).

If of recent growth, it is whitish, internally, and compact, breaking with a short, clean fracture. If, however, the root be of the previous year's growth, it may be porous and of a dark-brown color within, and consequently of less value as a drug.

Aconiti Folia.—Aconite leaves are often intermixed with some of the flowers, as well as leaves and blossoms of other blue-flowered species of the family. The leaves are smooth, coriaceous, somewhat rigid, glossy on the upper surface, having a sub-orbicular, or nearly cordate outline, which is deeply (3 to 5) cleft, producing long, narrow, cuneiform segments, deeply incised, and presenting lance-linear teeth. The taste is bitterish and acrid, and gives the well-known characteristic tingling sensation of aconite. They have but little, if any, odor.

Fig. 3.



Cross-section of an Aconite flower.

History.—Aconite is abundant in the mountainous woodlands of various parts of Europe, especially in France, along the Pyrenees, and in the rocky heights in Germany and Austria, Denmark, and the Scandinavian peninsula, and is abundant in the Alps and the Himalayas, where, with other species, it is found at a height of from 10,000 to 16.000 feet (*Pharmacographia*). It is plentiful throughout Siberia, and is cultivated to some extent in gardens, both in the United States and Europe, for its floral beauty. It is said to have been naturalized in portions of the British isles. Aconite tubers and leaves are frequently of very poor quality, and with foreign admixture as found in market, having been gathered without regard to season, species, or quality, by the poor peasants while engaged in watching the grazing herds. The shrivelled and decaying growth of the previous year is, as compared with the recent growth, relatively feebler. The aconites were well known to the ancient Greeks, Romans, and Chinese. It provided certain native tribes of the East with an active arrow poison. The root should be collected in winter or early spring; the leaves just before the blossoming period, or when the plant has but partially bloomed. The virtues of aconite remain intact upon drying, the whole plant being acrid and fully yielding its medicinal properties to alcohol. Various other plant species are present as admixtures, and especially, according to Holmes (*Pharm. Jour.*, 1877), are substituted the roots of the *Imperatoria Ostruthium*, Linné (European masterwort). As the latter tuber is aromatic, its detection is not difficult, though the roots somewhat resemble the aconite tubers. Good aconite is usually known by its characteristic benumbing taste. Aconite was introduced into modern medicine by Baron Störck, of Vienna, about 1762.

Chemical Composition.—Besides *mannite*, cane sugar, glucose, resin, and fats, aconite root contains aconitic acid ($H_3C_6H_3O_6$), usually combined with calcium in the form of calcium aconitate. This acid is also present in a number of other plants. It occurs in plate-like or warty crystals, soluble in alcohol, ether, and water. The most important constituent, however, is the alkaloid *aconitine* (*napaconitine, benzoyl-acetyl-aconine*) ($C_{33}H_{43}NO_{12}$, Wright; $C_{33}H_{45}NO_{12}$, Dunstan and Ince, 1891; $C_{34}H_{47}NO_{11}$, Freund and Beck, 1894), for a description of which and other constituents of aconitum usually present in the commercial alkaloid, see *Aconitine*. Aconite leaves contain, besides aconitine, gum, albumen, sugar, tannin, aconitic acid, an amorphous alkaloid, bitter to the taste, called *napelline*, which Hübschmann found to be identical with a substance previously isolated by him from another species of aconite (*Aconitum Lycoctonum*, Linné), and named *acolyctine*, but considered by C. R. A. Wright to be a decomposition product of *aconitine*. The tubers also contain a small amount of *napelline*.

Action and Toxicology.—Aconite is an energetic, acro-narcotic poison in improper doses, occasioning symptoms of gastric irritation, with great depression of nervous energy and brain. The usual effects of an improper dose of either the tincture or powder, are a prickling, or slight thrilling in the mouth and limbs, accompanied with a benumbing sensation, but without, as a rule, coma or convulsions. Several of the following symptoms will soon manifest themselves: Vomiting, perhaps great thirst, sometimes violent purging with painful spasms of the stomach and bowels, sense of great exhaustion, pale face, impaired vision, scarcely perceptible pulse, coldness of feet and legs, and coma, or delirium; and, from paralysis of the respiratory muscles, death follows. These symptoms may vary in different cases, though several of them will always be present. Gastritis and enteritis, with pulmonary and cerebral congestion, are exhibited upon a post-mortem examination.

Locally, aconite and its alkaloid produce a prickling sensation and numbness, followed by an impairment of the sensory nerves, resulting in anæsthesia of the part. Both are very irritating to the Schneiderian membrane and conjunctiva. Aconitine produces the effects of aconite, though in a much more exalted degree. Taken internally, in small amounts, aconite occasions a tingling, pricking sensation of the buccal cavity, fauces, and tongue, followed by more or less numbness. If not too large a quantity has been swallowed, these effects are overcome by a swallow of vinegar (Scudder). The tincture, in non-lethal doses, gives rise to a sense of gastric warmth and a general glow of the surface. Perspiration may be induced and the renal secretions augmented. Pyrexia is reduced when the pulse is frequent and feeble, if the drug be administered in minute doses.

In maximum medicinal doses, it causes gastric heat, which extends throughout the general system, and occasionally the pricking sensations will be experienced, with, perhaps, benumbing feelings; or, these may pass over the whole system, with dizziness, more or less pain in the head, acute pains, excessive depression of the vital forces, with feeble circulation and respiration. Aconitum should never be given in sufficient quantity to produce these effects. A drop of a solution of aconitum in the eye causes the pupil to contract. Larger amounts induce toxic symptoms, the principal of which are increase of tingling and numbness, or thrilling of the mouth and extremities, excessive perspiration rapidly lowering the body temperature, pupillary dilatation, dimness of sight, loss of hearing and the sense of touch, and diminished action of the sensory filaments supplying the skin. Muscular weakness is marked; trembling, and occasionally convulsions may ensue. Excessive depression comes on, and the power of standing is early lost. The feet and legs become cold, the face pale, and the patient has a tendency to faint. There may be violent burning in the stomach, with great thirst and dysphagia, and vomiting and diarrhœa may occur. The pulse is weak, rapid, and almost imperceptible; acute, lancinating pain may be felt, and more or less delirium may result, though as a rule the intellect remains unimpaired. The manner in which aconite affects the nervous system is not yet definitely known. That it is a heart paralyzer, seems to be an accepted fact. Death may result from syncope, though usually it occurs from respiratory paralysis. The action of a lethal dose is rapid—toxic symptoms showing themselves within a few moments. The treatment consists in keeping the patient in a recumbent position, with the feet slightly elevated. External heat should be applied, and stimulants (as brandy, ammonia, ether) administered. It is stated that digitalin previously administered, to animals, wholly prevented the toxic action of *aconitine* (Fothergill); hence digitalis is recommended to antidote aconite poisoning. Tannin (astringents) is said, also, to be an efficient antidote. Inhalations of nitrite of amyl were resorted to in one case with good results. Strychnine, atropine, or strophanthus may be cautiously administered. In no case allow the patient to arise from the recumbent posture, lest death suddenly take place from syncope. The stomach should, of course, be promptly evacuated with the stomach-pump, or emetics and artificial respiration resorted to, if necessary, for the prevention of respiratory paralysis.

Medical Action, Uses, and Dosage.—Therapeutically, aconite is a special sedative, and, according to Prof. J. M. Scudder, is the remedy when there is difficulty in the capillary circulation, a dilatation and want of tone in these vessels, as it moderates the force and frequency of the heart's action, increasing the power of the heart and the tone of the blood-vessels, and hence is advantageous in asthenia and extreme debility; it also has a tendency to lessen pain and nervous irritation. He considered it the remedy in cases where there is a frequent but free circulation; where there is an active capillary circulation; and where there is a marked enfeeblement of the circulation, manifested by a frequent, small pulse, a hard and wiry pulse, a frequent, open, and easily compressed pulse, a rebounding pulse, or an irregular pulse. In *congestion*, especially of the nerve-centers, to relieve coma, and in *diabetes insipidus*, he associated its administration with belladonna; with the bitter tonics in *phosphuria* and *oxaluria*; and with the mineral acids in *night-sweats*. While it acts upon the excretory organs, increasing excretion, yet it controls excessive activity of these organs, whether of the skin, bowels, or kidneys, and hence its value in *summer complaint* of children (*Ec. Med. Jour.*, 1868, p. 430).

With the *small, frequent* pulse, whether corded or easily compressed, aconite is a remedy of wide applicability in asthenic or adynamic states. Our old school competitors assert that aconite should never be given only in sthenic conditions, but their conclusions are evidently based upon the use of too large doses. Given in the minute dose, as employed by our physicians, it tends toward a restoration of normal action. With the characteristic pulse, its action in *fevers* is to reduce the temperature, generally in the proportion in which it controls the frequency of the heart-beat; if, on the other hand, the temperature be subnormal, as in the cold stage of fevers, *congestive chill*, or in *Asiatic cholera*, the minute dose increases the warmth of the body, giving volume and freedom to the pulse, and tending toward a normal circulation.

"If we note its action in active inflammation, we notice that it lessens determination of blood, quiets the irritation, checks the rapid circulation in the capillaries where it is too active, and increases the circulation where it is sluggish. If, as we think, it acts upon and through the ganglionic system of nerves, we can account for all this by saying that it gives *right* innervation. I have been in the habit of saying that aconite was a stimulant to the heart, arteries, and capillaries, because whilst it lessened the frequency, it increased the power of the apparatus engaged in the circulation" (Scudder, *Dis. of Child.*, 42. 43). It must be remembered that our term sedative differs somewhat from that accepted by other schools. A remedy, such as aconite, which in minute doses will stimulate the vascular system to normal activity, and thereby reduce febrile states by correcting innervation, comes under our class of "special sedatives." As a special sedative, it is useful in all *asthenic febrile* and *inflammatory diseases*, and, indeed, in all affections in which there is an increase of nervous, vascular, or muscular action with determination of blood to the parts. In *scarlatina*, *inflammatory fever*, *acute rheumatism*, *peritonitis*, *gastritis*, and many other acute disorders, it has been used with the most decided advantage. Added to cimicifuga, it greatly increases the curative influence of this agent in *acute rheumatism*, and more especially where there is a tendency to muscular spasm. "In cases of pure *inflammatory rheumatism*, independent of any organic lesion, and with no septic processes going on in the blood, aconite is an absolute specific" (Locke). By its beneficial action upon the sensory nerves, it is a remedy of marked value in various forms of *neuralgia*. In *facial neuralgia*, not due to carious teeth, it may be aided by piper methysticum (Webster), and is especially applicable when febrile phenomena are present. In *rectal neuralgia*, it may be used with æsculus glabra, æsculus hippocastanum, collinsonia, or hamamelis, as indicated; in *visceral neuralgia*, with æsculus glabra. Its action in neuralgias is not pronounced in most instances when administered alone, but it greatly aids the other indicated remedies, particularly where fever is a concomitant condition. *Peridental inflammation* is allayed by it.

In *simple fevers*, aconite aids diagnosis. "If in twelve hours' treatment with aconite the patient is not well, or markedly improved, he has more than a case of simple fever" (Locke). In *typhoid fever*, it cannot arrest the disease, though it may be used, if clearly indicated, which we believe is rarely; baptisia is a much better remedy here. *Rheumatic* and *intermittent fevers* are benefited by it, especially when slight chilly sensations are repeatedly experienced. *Gastric fever*, with yellow-coated tongue, bad taste, and diarrhœa of undigested aliment, is controlled with aconite in small doses. Its action is marked in many *inflammatory skin diseases*. In *erysipelas*, when high fever is present, never omit aconite (Locke). In *brain* and *meningeal disorders*, it is frequently of marked advantage. Add to the characteristic pulse a hyperemic state of the superficial cerebral and meningeal vessels, and your case is one for aconite. If there be great excitation, gelsemium will aid its action; if congestion, belladonna. *Insomnia*, from nervous erethism, points to aconite for its relief. Such a state, bordering upon convulsions, sometimes depends upon *teething* and *gastro-intestinal diseases*. *Mental perturbation*, with fever, and a fear of impending disaster, with melancholia, is said to be relieved by aconite. Webster pronounces it "the pulsatilla of the febrile state."

By its control over the sympathetic nervous system, and its influence on the circulation and temperature, aconite becomes one of the most important remedies in the treatment of respiratory lesions. If the temperature is high, it reduces it; if it be abnormally low, it raises it to its normal standard. It is the remedy for all asthenic inflammatory and febrile conditions, especially in their earlier manifestations. It is the remedy for hyperemia; it is the remedy for loss of tone in the capillary structures resulting in inflammation. Loss of tone in a part causes capillary stasis, which, if allowed to go on, results in congestion, and, continuing, ends in inflammation. Here aconite controls the circulation, allays the irritation, lowers the temperature, and re-establishes the secretions. It acts as a gentle stimulant to the sympathetic system, consequently it has a good influence over irritation and inflammation in the parts supplied by it. Aconite is the remedy for irritation of the mucous surfaces. *Acute catarrh*, nasal and faucial, *acute pharyngitis*, and *ulcerated tonsils*, with elevated temperature, yield to aconite. It is the first remedy to be thought of in *tonsillitis*, *spasmodic* and *mucous croup*, and it is not without value in the pseudo-membranous form of croup. It may be used internally and locally. In spasmodic croup it allays the spasm, and the dyspnœa is quickly relieved. In tonsillitis it materially lessens the duration of the disease. It may be used early by spray, and given internally in small doses. Associated with gelsemium, it is of value in a large percentage of cases of "*la grippe*." In cases of *acute coryza*, it controls the febrile phenomena. In *pneumonia*, catarrhal or fibrinous, it is of signal value in the earlier stage to control the inflammatory process. It is good, though of less value, in the latter stage of the same malady, when bryonia is to be preferred. Its use in *acute bronchitis* and *laryngitis* gives good results. In *pleurisy*, it should be associated with bryonia in the earlier stage, with sharp pain, marked chill and high temperature, and the use of the latter agent should be continued to remove the effusions after the acute pains have subsided. It is one of the best agents to prevent *acute catarrhal pneumonitis*, as a complication of *measles*, and one of the best to control it in case it does supervene. The remedy should be administered in *phthisis*, to regulate the temperature, and is very valuable when new portions of the lung tissue are being invaded by the inflammatory process. It is said to give relief in *asthma*, with high temperature. Give the drug in small doses, frequently repeated, in acute disease; 3 or 4 times a day in chronic conditions.

No remedies surpass aconite and belladonna in the *exanthematous diseases*, and very frequently no other remedy than aconite will be indicated in *scarlatina* and *measles*. Here the hot, dry skin, with vascular excitation, calls for the drug, the temperature falling as soon as the eruption appears, which aconite aids in bringing out. Recent *amenorrhœa*, due to cold, is amenable to aconite if the circulation and temperature be increased. *Disorders of the menopause*, with alternate chills and flushes of heat, "with rush of blood to the head," cardiac palpitation, dyspnœa, gastric fullness, and sense of distension in the bladder, with frequent attempts to pass urine, are relieved by the usual dose of aconite every half hour (Locke). In *uterine hemorrhage*, as *menorrhagia*, with hot, dry face and excited circulation, aconite will relieve. In *cardiac diseases*, it has been employed with good results when there is *palpitation*, depending upon irritation; and for *heart spasm*, with a feeling of suffocation and as if the heart's action would cease, it is a prompt remedy.

Aconite is one of the first remedies for *gastro-intestinal diseases*, and especially the bowel troubles of children. All such disorders resulting from cold, or with inflammation, demand aconite as a part of the treatment. In *aphthous conditions*, with fever, associate it with phytolacca. It relieves *gastric irritation*, and may be associated with amygdalus, rhus, and ipecac. *Diarrhœa*, *cholera infantum*, *cholera* *morbus* and *acute gastro-intestinal irritation*, usually yield to aconite and ipecac; while in *dysentery*, aconite, associated with ipecac and magnesium sulphate, is very prompt in controlling the disease. It is often indicated in the *diarrhœa of teething*.

A *hyperemic, œdematous conjunctiva*, with a feeling of burning and dryness, are the indications for its use locally and internally in inflammatory affections of the eye and its appendages. It shortens the inflammatory stage and allays pain in *acute catarrh of the middle ear*, though suppuration can not always be averted. The same result is obtained by its internal and external use in *mastoid disease*. Locally, aconite has been used in painful and neuralgic states, but is not much employed in this manner by our physicians. The usual prescription is: ℞ Specific aconite, gtt. ij to v; aqua, fl℥ iv. Mix. Sig. Dose, a teaspoonful every ½ to 1 hour.

Dose: Tincture of aconite, 1 to 3 drops; extract of aconite, 1 to 2 grains; fluid extract of aconite, ¼ to 1 drop; specific aconite $\frac{1}{20}$ to ½ drop. The larger doses should seldom be employed.

Specific Indications and Uses.—The *small and frequent pulse*, whether corded or compressible, is the direct indication; asthenic febrile state, with or without restlessness; chilly sensations; skin hot and dry, with small, frequent pulse; irritation of mucous membranes, with vascular excitation and determination of blood; hyperemia; tonsillitis and laryngitis, early stage; simple colitis.

Related Drugs and Species.—*Aconitum Lycoctonum*, Linné. This plant yielded Hübschmann two alkaloids, *acolyctine* (previously called by him *napelline*) in powdered form, and *lycoctonine* in crystalline needles. According to Flückiger, it is identical with neither aconitine nor pseudaconitine. Wright regards *lycoctonine* as identical with *aconine*, and *acolyctine* with *pseudaconine*. Dragendorff and Spohn, on the contrary, state the constituents of this plant to be *lycaconitine* ($C_{27}H_{34}N_2O_6.2H_2O$), and *myoctonine* ($C_{27}H_{30}N_2O_8.5H_{20}$), the former of which, when boiled with water under pressure, splits into a volatile acid and *lycoctonic acid* ($C_{17}H_{18}N_2O_7$), and an alkaloid soluble in ether, *lycaconine*, and a second one, probably the *acolyctine* of Hübschmann, soluble in chloroform. Hübschmann's *napelline* is regarded by Mandel as a mixture of aconine and aconitine in variable amounts. The status of the constituents of the several aconites does not seem as yet to be well understood.

Bishma, or Bikhma.—*Wakhma*. This variety is furnished by the *Aconitum palmatum*, Don. The tubers are very bitter, but non-acrid. They contain a non-toxic, bitter alkaloid. Wakhma is reputed tonic.

Japanese and Chinese Aconite.—This drug consists of the tubers of several species of aconite variously preserved, sometimes, it is said, in child's or cow's urine, or in vinegar, or dried and salted. They are poisonous in varying degree, those of the *Aconitum Fischeri*, Reichenbach, being regarded as the most virulent. *Aconitum Chinense*, Siebold, and *Aconitum Japonicum*, Thunberg, as well as other species, amounting to seven altogether, are said to furnish this kind of aconite. An extremely poisonous principle, *japaconitine* ($C_{66}H_{88}N_2O_{21}$), has been isolated from Japanese aconite-tubers. It splits into benzoic acid and *japaconine*, when saponified (see *Aconitum Fischeri*).

Atis, or Ativish.—*Atees, Utees*, etc. The tuberous roots of the *Aconitum heterophyllum*, Wallich, a species growing in the Himalayan country, constitute the *atis* of East Indian medicine. It is employed in its native country as a bitter tonic and antiperiodic, and is used as a vegetable (G. Watt). *Atisine*, discovered by Broughton, is the active constituent, and is a non-toxic, intensely bitter alkaloid. Broughton gave it the formula $C_{46}H_{74}N_2O_5$; Wright (1878) suggests $C_{22}H_{31}NO_2$ as being more nearly correct. Wacowitz (1879) found besides *atisine*, probably another amorphous alkaloid, sugar, mucilage, pectin, aconitic acid, starch, and a soft fat, which he thought to be a mixture of oleic, stearic and palmitic glycerides, and an acid resembling tannic acid. Pure *atisine* is white, amorphous, and exists only in minute quantities in the drug (Dymock, *Mat. Med. of Western India*).

Bish, Bis, Bikh, Bikli, or Nepaul Aconite.—This variety is chiefly made up of the tubers of *Aconitum ferox*, Wallich, though *Aconitum napellus, Aconitum palmatum*, and other species probably contribute a portion. This variety is intensely acrid and poisonous. Its chief active constituent is the extremely poisonous *pseudaconitine* [*feraconitine*] ($C_{36}H_{49}NO_{12}$); and has also been termed, by Ludwig, *acraconitine*; by Wiggers, *napelline*; and by Flückiger, *nepaline*. F. Mandelin (*Arch. der Pharm.*, 1885) believes aconitine and pseudaconitine pharmacologically the same, and regards them as the strongest of known poisons. He also regards *japaconitine, aconitine*, and *benzoylaconine*, as identical. *Pseudaconine* ($C_{36}H_{49}NO_{12}+H_2O$), a new base formed by the saponification of *pseudaconitine*, and *aconine* ($C_{20}H_{39}NO_{11}$), one of the saponification products of aconitine, are regarded by the same investigator as either identical or homologous, and both poisonous, though less so than aconitine and pseudaconitine. Mandelin also believes that the difference in the poisonous effects of *Aconitum ferox* and *Aconitum napellus* depends wholly upon the relative amount of aconitine present in the two plants, and not upon any difference in virulence of the active principles of either. (See Dymock, *Mat. Med. of Western India*). Dymock states that Hindu authors mention "eighteen kinds of *Bish*, or poison," ten of which are too poisonous for medicinal use; also, that the word *bish* appears to have been applied "to any very poisonous root."

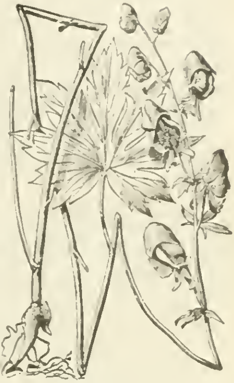
ACONITUM FISCHERI.—AMERICAN ACONITE.

The tuberous roots of *Aconitum Fischeri*, Reichenbach.
Nat. Ord.—Ranunculaceæ.
COMMON NAME.—*American aconite.*
ILLUSTRATION.—Lloyd's *Drugs and Medicines of North America*, Pl. XVII.

Botanical Source and History.—Though said to be the most active and poisonous of the species furnishing Japanese aconite root (Geerts, 1880), on account of its abundance in America and its likelihood of some day being the source of aconite for use in this country, we have taken the liberty to name this plant the *American aconite*.

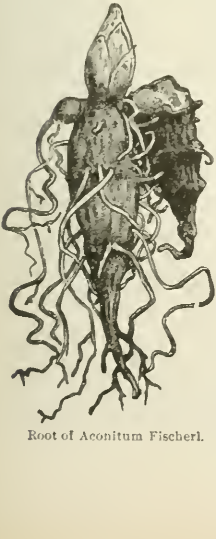
Aconitum Fischeri, Reichenbach, is found in the Rocky Mountain region of the United States; also in other sections of the world. The plant is particularly mentioned here on account of the fact that its chemical properties are similar to those of aconite, and Prof. J. U. Lloyd, who has made an exhaustive study of the plant, prophesies that it may, at some future date, be an important source of aconite. In view of this fact, we extract from *Drugs and Medicines of North America*, by J. U. and C. G. Lloyd, a full botanical description of the plant: "This plant is quite common along the banks of streams in the mountains of the Western States. It is generally found near the tops of mountains and in mossy and boggy places. It usually grows near the water or in it, but never where the water is not fresh. It grows at an altitude of from 7,000 to 11,000 feet above sea level. The stem is erect and about 3 or 4 feet high, although in some favored situations it attains a height of 10 feet. The stem is smooth, except on the upper flowering portion, which is covered with a short pubescence. The leaves are orbicular in outline, and deeply three to five-lobed; the segments are acute, and coarsely and sharply-toothed. The leaf stalks are 2 to 6 inches long. The flowers appear in August or September, and are borne in a terminal loose raceme. They have the usual odd aconite shape, and can be recognized at once. They are usually of a deep-blue color, but vary to nearly white in some instances. Sometimes plants are found with bronzed flowers"—(*Drugs and Medicines of North America*). It is an extremely variable plant, having been found in several forms.

Fig. 4.



Aconitum Fischeri.

Fig. 5.



Root of Aconitum Fischeri.

Description.—The root of *Aconitum Fischeri* is described by the authors of *Drugs and Medicines of North America* as follows: "Our engraving (Fig. 5) represents the average size of the roots obtained by us. It will be observed that they are cylindrical and taper at the lower extremity. They are, as a rule, of greatest diameter about one-fourth the distance below the top, approaching, by a graceful curve, the constriction that separates the stalk from the root. The parent root produces each season a small tuberous root (sometimes more) at the base of the stalk, which develops and increases during the season until it is of full size; then the stalk dies, the mother root shrinks and decays, the young root forms a terminal bud in anticipation of the coming season, and also begins to send out the new root. Our engraving exhibits these several phases, the old, contorted, shriveled root being upon the right; the succulent, plump, young root, fully developed, in the center, and with its terminal bud; the new root for next season upon the left"—(*Drugs and Medicines of North America*). The root closely resembles the aconite root of commerce, develops in the same manner, is bitter to the taste, and has the peculiar benumbing effect upon the tongue which is possessed by true aconite.

Chemical Composition.—Prof. F. B. Power, at the request of Prof. J. U. Lloyd, has investigated the chemical properties of this plant, though owing to the lack of material at the time was unable to state definitely what the constituents were. He established conclusively, however, that the drug contained an alkaloid or alkaloids. Prof. Lloyd states, basing his views on the physiological investigations of Prof. Roberts Bartholow, undertaken at Prof. Lloyd's request, that the drug undoubtedly contains *aconitine*, associated with other proximate principles (see *Drugs and Medicines of North America*, p. 228). Paul and Kingzett have obtained from it an alkaloid, which has been named *japaconitine* ($C_{66}H_{88}N_2O_{21}$), a principle said by F. Mandelin (*Arch. der Pharm.*, 1885) to be identical with *benzoylaconine*. It has a close resemblance to Wright's *aconitine*. By saponification, it is resolved into *japaconine* ($C_{26}H_{41}NO_{10}$) and benzoic acid.

Action and Medical Uses.—American aconite has not been used to any extent in medicine, but in view of the fact that its constituents are probably similar to those of aconite, the drug should be studied to determine its action and therapeutical value.

Related Species.—*Aconitum uncinatum*, Linné, and *Aconitum reclinatum*, Gray, are also found in the Western States, but are unimportant. The last has not been chemically examined, and is probably inert; the former has proved to be practically inert as a medicine. V. Coblentz, at the request of Prof. Llyod, examined it and found in it a glucosid, and a bitter, non-crystalline body of an alkaloidal character. Climate probably modifies the action of the aconites, as this species, in India, is poisonous and furnishes a portion of *Bish*.

ACTÆA ALBA.—WHITE COHOSH.

The rhizome and rootlets of the *Actæa alba*, Bigelow.

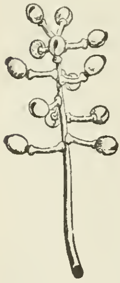
Nat. Ord.—Ranunculaceæ.

Common Names.—*White cohosh*, *White baneberry*, *Necklace weed*, *White beads*.

Illustration.—*Drugs and Medicines of North America*, by J. U. and C. G. Lloyd, Pl. XVIII.

Botanical Source.—Actæa alba is a perennial herb, having an erect stem about 2 feet high, bearing two large tri-ternate leaves, the leaflets of which are nearly oval, acute, serrate, and somewhat lobed. The flowers, which are handsome, showy, and white, are borne on a short, compact, oblong raceme with pedicles as large as the general peduncle. The petals are truncate at the apex, equalling the stamens. The fruit is a berry about the size of a cherry-pit, of an ivory white color, with an occasional tinge of red at the apex. These berries range from about 10 to 20 in number.

Fig. 6.



Fruit of Actæa alba.

Description.—The rhizome, which grows just beneath the surface of the soil, is about an eighth of an inch thick, fleshy, knotted, and has many fibrous rootlets. It weighs from 1 to 2 ounces when green. Where the stem joins the rhizome there is an enlargement which is often nearly an inch in thickness. Several offshoots, from 1 to 4 inches long, are given off from the main root. When mature the rhizome is usually decayed at one end and growing at the other. The young rhizome is sweetish, but less so than the mature rhizome which, however, is not so acrid as the former, having but a very faint acridity. The sweet taste is persistent, that of the younger having been compared to that of glycyrrhizin (Lloyd, *Drugs and Medicines of North America*). The dried is darker than the fresh root, shrunken, very hard, and has a sweet taste. The drug loses three-fourths of its weight in drying.

History and Constituents.—The cohoshes have received their name from the aborigines, who employed them as medicines. According to Barton they used them for rheumatism, but depended more upon their topical than their internal action. They also employed them as emmenagogues and parturients. *Actæa alba* grows in the rich mold of rocky forests and hillsides throughout the Union, east of the Mississippi. Though pretty evenly distributed, it is nowhere an abundant plant. It blooms in May, about a week later than the red cohosh, and matures its fruit in July and August, several weeks later than the latter. It is frequently found as an adulterant among commercial lots of cimicifuga, but is not considered objectionable, as it undoubtedly possesses properties similar to those of black cohosh.

William Dillmore (1874) found the plant to contain albumen, sugar, starch, gum, and extractive, but neither tannic nor gallic acids. (The *A. spicata* is said to contain tannin). Two resins were also obtained, one soluble and the other insoluble in ether. Both, however, were dissolved by alkalies. The aqueous liquid, after precipitation of the resins from alcoholic solution, behaved like a solution of saponin. Prof. J. U. Lloyd (*Drugs and Medicines of North America*), obtained a resin exactly like the purified resin of black cohosh, which was neither acrid nor bitter, differing from Dillmore's resin, which was probably obtained from a drug mixed with spurious roots. Lloyd also obtained a tincture having a pure, sweet taste, without either acridity or bitterness. Chemically, as well as in other ways, this drug differs but little from cimicifuga, but owing to its scarcity as compared with the latter, it will probably never take its place as a medicine.

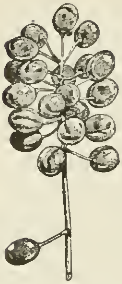
Action, Medical Uses, and Dosage.—White cohosh is an active agent, and in large doses will produce violent emeto-catharsis. Grave irritation and gastro-intestinal inflammation have resulted from over-doses of the drug. It has been variously classed as alterative, emmenagogue, parturient, narcotic, purgative, and nerve stimulant. It specially acts upon the female reproductive organs, and favors waste and nutrition. The conditions in which it is useful are those of atony, and especially of nervous impairment. *Atonic digestive derangements*, with a low state of the nervous system, and *chronic constipation*, are cases for this drug. Its most decisive action, however, is in the disorders of the female organs. It is reputed a good *partus preparator*, and Dr. W. Fulton (see *Specific Medication*), accords it a first place in *puerperal after-pains*, and suggests its employment in *uterine congestion* and *neuralgia*. We would add here that it should be selected in debilitated states. It should be thought of in *menstrual irregularities* and other wrongs, as *amenorrhœa*, *menorrhagia*, and *dysmenorrhœa*. Those *ovarian affections*, attended with an unpleasant feeling and extreme sensibility to external touch or pressure, are asserted to be improved by its employment. Added to these may be headache, delirium, insomnia, and melancholia. When spasmodic diseases are due to menstrual wrongs—*chorea*, *epilepsy*, *hysteria*, and other convulsive attacks—the remedy is said to be curative. In *leucorrhœa* and *uterine prolapse* it should be used both locally and internally. In general its field of action is quite similar to that of cimicifuga. A peculiar pinkish hue of the part freely supplied by blood, usually associated with menstrual wrongs, is, according to Prof. Scudder (*Specific Diagnosis*), an indication for this drug, as well as for pulsatilla and helonias.

Dose: Decoction so made as to represent about 30 grains of the root, at one dose. Specific actæa, 1 to 20 drops. For its specific application the following is preferred: ℞ Spec. actæa gtt. xx.; aqua fl℥iv. Mix. Dose, a teaspoonful every 1 to 3 hours.

Specific Indications and Uses.—Atony of the nervous system associated with reproductive wrongs, headache, delirium, insomnia, melancholia, and convulsions; uneasy sensations in, and marked sensibility to the touch, or upon pressure, in the ovarian region; pinkish hue of the parts freely supplied by blood. Atonic states only.

Related Species.—*Actæa spicata*, Linné. *Baneberry, Herb Christopher.* Elevated parts of Europe, Caucasus, and Siberia. Grows to a height of 3 or 4 feet, having bi- or tri-ternate leaves, an ovoid raceme of white flowers, and glossy-black, juicy berries. The rhizome is blackish-brown, and when fresh has a disagreeable, bitter, acrimonious taste, followed by a sweet after-taste. The odor is nauseous, but when dried the root is nearly odorless. It gives its properties to water and alcohol. The berries are poisonous, causing mental hallucination, gastric irritation, and even death. The green root is violently purgative, resembling black hellebore, but less so when dried, and has emmenagogue properties. A decoction used locally, destroys lice, fleas, and the itch insect. Hens and ducks are killed by the berries, but herbivorous animals eat the plant with impunity. It is sometimes found as an adulterant of black hellebore.

Fig. 7.



Fruit of Actæa spicata, var. rubra.

Prof. Scudder (*Specific Medication*, 59), suggested its use in small doses (R Tr. actæa spicata gtt. ij, aqua fl℥ iv. Mix. Dose, a teaspoonful, in *diarrhœa*, *dysentery*, some forms of *colic*, and *urinary diseases* with tenesmic passages of urine.

Actæa spicata, Linné, var. *rubra*, Aiton. *Red cohosh*, *Red baneberry*. This species inhabits the United States east of the Mississippi river, from Canada southward. It is almost identical in appearance with the *Actæa alba*, and they can hardly be distinguished from each other unless they are in fruit, though the latter flowers a week or so later than the red cohosh. The fruit of this variety (for it is only considered by botanists as a variety of the European species, *Actæa spicata*), is a glossy, cherry-red berry, of which the plant bears from 20 to 24. They ripen in early July. It was employed by the Indians under the name of red cohosh. It probably possesses similar properties to those of cimicifuga and the other actæas. *Actæa spicata, var. arguta*, Western United States, is another variety.

ADANSONIA.—BAOBAB.

The bark of *Adansonia digitata*, Linné.

Nat. Ord.—Malvaceæ.

Common Names.—*Baobab*, *Monkey-bread tree*, *Sour-gourd tree*, *Cream-of-tartar tree*.

Illustrations.—*Bot. Mag.*, Pl. 2791 and 2792.

Botanical Source and History.—*Adansonia digitata* is a large tree of the western coast of Africa and Egypt, sometimes attaining huge dimensions, being often 25 feet in diameter, although the height is not nearly so great in proportion. It was formerly supposed to attain a great age, and Adanson, a French botanist, in whose honor the tree was named, estimated a tree on the islands of Cape de Verd to be over 5,000 years old, a point disputed by Bentham, who asserts that *A. digitata* is of rapid growth and comparatively short-lived. It is the baobab tree of travelers, and also known as monkey-bread, cream of tartar tree, and sour-gourd tree. The local name is *Gowik Chentz* or *Churee Chentz*.

The leaves are digitate, and consist of five acute elliptical leaflets, resembling the leaves of our common buckeye. The flowers are very large and suspended on long peduncles; the calyx not having the peculiar involucre at its base which characterizes many genera of the Malvaceæ. The style is long, exserted from the staminal column, and bears a 10-rayed stigma. The fruit, which is nearly a foot long, is divided into 10 cells filled with an agreeably acid pulp in which the seed are imbedded.

The baobab tree belongs to the section Bombaceæ, of the natural order Malvaceæ, by De Candolle considered sufficiently distinct to form a separate natural order, which differs from Malveæ (the typical form of Malvaceæ) in having the calyx imbricated in the bud, and the staminiferous tube divided into five bundles at the apex; whereas the stamens of the Malveæ are perfectly monadelphous. The fruit of this tree, which is cucumber- or bottle-shaped, is used by the natives for fishing-net floats and as water vessels. The native Africans employ the cream-of-tartar-like or sub-acid, mucilaginous pulp as a remedy for dysentery, and poultice inflammations with the leaves. They also use to control excessive perspiration a powder (called *Lalo*) of the dried leaves. Combined with buttermilk it is used in Bombay for its astringent effect in dysentery and diarrhœa, and the sub-acid pulp is given with figs by the Concans for asthma (Dymock).

Description.—The bark is the part employed, and, together with the leaves and flowers of the tree, contains much mucilaginous matter. When fresh it is about five-eighths of an inch in thickness, brown, with a rough epidermis. A section shows the structure to consist of a mixture of pitted wood cells devoid of general arrangement. The cut surface of a transverse section is mottled yellowish-green, and reddish-brown, uniting with the woody fiber of the trunk.

Chemical Composition.—The decoction of the bark decomposes rapidly, owing to the mucilaginous material present; however, this may be prevented by the addition of alcohol, or a small quantity of sulphuric acid. By treatment with alcohol, subsequently evaporating, then digesting with litharge, and extracting with ether, upon evaporating the ether white needles of an extremely bitter taste are obtained, named *adansonin*. These are fusible, dissolve in 6 parts of cold and 3 of boiling ether, are soluble in alcohol, and but slightly so in water; they are not precipitated from their solution by alkalies, and chloride of iron imparts a greenish tinge to the alcoholic solution. Their formula is $C_{48}H_{36}O_{3}$ (Wittstein). Acid malate of potassium, glucose, pectin, and tartaric acid have been found in the pulpy substance surrounding the seeds.

Action, Medical Uses, and Dosage.—According to M. Duchassaing, the bark of this tree possesses febrifuge properties, and although devoid of bitterness, may be beneficially substituted for cinchona; since its introduction into our markets, no satisfactory report has been made of its virtues in this respect. The juice of the fruit is stated to be employed in its native country as a remedy in *putrid* and *pestilential fevers;* and a decoction of the nut, in *dysentery*. A decoction of the bark (1 oz. in 1 quart of water boiled to 1½ pints) is of a reddish color, somewhat resembling that of decoction of cinchona (*Comp. Rend.*, xxvi, 1848, and *Jour. de Pharm.*, June, 1845). A pint and a half of the decoction may be taken in a day.

ADEPS (U. S. P.)—LARD.

"The prepared internal fat of the abdomen of *Sus scrofa*, Linné (class *Mammalia;* order *Pachydermata*), purified by washing with water, melting, and straining. Lard should be kept in well-closed vessels impervious to fat, and in a cool place"—(*U. S. P.*).

SYNONYMS: *Prepared lard, Hog's lard, Axunge.*

Source and Preparation.—Lard should preferably be prepared from "leaf fat" obtained from the omenta, mesenteries, and kidneys of the common hog killed during the winter or early spring months. The fat should be thoroughly cleansed from extraneous material, as dirt, blood, etc., and the outer membranous portion of the leaf torn off, after which the perfectly fresh fat should be suspended in the air for a short time. It must then be beaten in a stone mortar until the fibrous, vesicular walls of the cells are broken and the mass becomes uniform throughout, and then heated in a water-bath to 54.4° C. (130° F.). Separate the remaining membranous parts, and strain through flannel or linen, after which it may be filtered through paper in a warm atmosphere. It should then be put into impervious containers, cooled, covered with waxed or varnished paper, and kept in a dark, cool, dry place, preferably a cellar, otherwise by the action of the atmospheric oxygen it will speedily become unfit for medicinal use.

Description and Chemical Composition.—Lard used for medicinal purposes should not contain salt; when good it is white, somewhat translucent, of granular appearance, smooth to the touch, somewhat of the consistency of butter, having a faintly-sweetish taste, and a faint, but not rancid, odor; but by exposure to the air it absorbs oxygen, and acquires an unpleasant odor and rancid properties. It is bland to the taste. Water does not dissolve it, and alcohol but slightly; ether, chloroform, benzin, benzol, and carbon disulphide are solvents of it, and so are the essential oils. The concentrated acids decompose it, and caustic alkaline solutions form soap with it, when boiled together. "Specific gravity about 0.932 at 15° C. (59° F.). It melts at 38° to 40° C. (100.4° to 104° F.) to a perfectly clear liquid, which is colorless in thin layers, and which should not separate an aqueous layer. At or below 30° C. (86° F.) it is a soft solid"—(*U. S. P.*). When melted it combines with resins, wax, and fixed oils, forming ointments, liniments, etc., as may be required. When heated in close vessels, it undergoes a process of destructive distillation, by which palmitic, oleic, acetic, and probably benzoic acids are formed, together with other less important modifications of its constituent fatty principles—*i. e.*, glycerides of oleic, stearic, and palmitic acids; these are found in most animal oils and fats, whose hardness or softness is owing to the relative quantity which they contain of each of these principles (see *Soap*).

OLEIN, or the *Glyceride of oleic acid*, is the liquid principle of oils, and is unknown in the native state. It is an oily fluid, devoid of color, taste, and odor, of specific gravity about 0.900, is partially dissolved by alcohol, but not by water, readily so by ether, and becomes solid at —6.6° C. (20° F.). It is convertible by saponification into glycerin and oleic acid. Its formula is $C_3H_5.3(C_{18}H_{33}O_2)$. It is said to be used to adulterate olive oil.

STEARIN ($C_3H_5.3[C_{18}H_{35}O_2]$), or *Glyceride of stearic acid*, is a crystalline solid somewhat resembling cetaceum, is sufficiently friable to admit of pulverization, freely dissolved by ether at 35.5° C. (96° F.), but is completely separated again on cooling, is insoluble in alcohol and water, melts at 62.2° C. (144° F.), and is convertible by saponification into stearic acid and glycerin. It may be obtained from lard or mutton tallow, by washing either of these with ether until they suffer no more loss; the stearin remains behind, and may be collected in flakes by boiling it in alcohol and then allowing it to cool. This substance should not be confused with the stearin used in the making of stearin candles, which consists mainly of free stearic and palmitic acids, to which some wax is added to prevent crystallization.

PALMITIN, or *Glyceride of palmitic acid*, is a solid constituent found in the oily portion of the fat. Its formula is $C_3H_5.3(C_{16}H_{31}O_2)$. When lard is subjected to pressure at the temperature of 0° C. (32° F.) palmitin and stearin may be separated. The remaining fluid is then known in commerce as *lard oil.* Lard contains from 32 to 40 per cent of solid constituents. Margarin is a mixture of stearin and palmitin.

By incorporating with lard, while hot, a small amount of benzoin or benzoic acid, and stirring until cold, rancidity is prevented. Poplar buds, various balsams, and some volatile oils have the same effect. Pure benzoic acid should not be used, but rather the ordinary acid prepared from the gum, which still retains balsamic qualities.

Adulterations and Tests.—Lard is sometimes treated with common salt to prevent its becoming rancid. Again, for the purpose of yielding a whiter lard and to render the incorporation of water with it less difficult, salt of tartar is added to it by dishonest dealers. Boiling with water, and again fusing the lard, repeating the process if necessary, will remove these impurities. The most largely employed adulterant of lard, however, is cotton-seed oil. When heated, if the lard contains it, the foreign admixture may be detected by its odor. The *U. S. P.* indicates the following tests of the purity of lard: "Distilled water boiled with lard should not acquire an alkaline reaction (absence of alkalies), nor should another portion be colored blue by iodine T.S. (absence of starch). A portion of the water when filtered, acidulated with nitric acid, and treated with silver nitrate T.S., should not yield a white precipitate soluble in ammonia (absence of chlorides). If 10 Gm. of lard be dissolved in chloroform, and the solution mixed with 10 Cc. of alcohol and 1 drop of phenolphtalein T.S., it should not require more than 0.2 Cc. of normal potassium hydrate V.S. to produce a pink tint after strong shaking (limit of free fatty acids). If 5 Cc. of melted and filtered lard be, while warm, intimately mixed, by agitation, in a test-tube with 5 Cc. of an alcoholic solution of silver nitrate (made by dissolving 0.1 Gm. of silver nitrate in 10 Cc. of deodorized alcohol and adding 2 drops of nitric acid), and the mixture then heated for 5 minutes in a water-bath, the liquid fat should not acquire a reddish or brown color, nor should any dark color be produced at the line of contact of the two liquids (absence of more than about 5 per cent of cotton-seed fats)"—(*U. S. P.*).

ADEPS BENZOINATUS (*U. S. P.*). *Benzoinated lard.*

Preparation.—"Lard, one thousand grammes (1000 Gm.) [2 lb. av., 3 oz., 120 grs.]; benzoin, in coarse powder, twenty grammes (20 Gm.) [309 grs.]. Melt the lard by means of a water-bath. Tie the benzoin loosely in a piece of coarse muslin, suspend it in the melted lard, and, stirring frequently, continue the heat for 2 hours, covering the vessel and not allowing the temperature to rise above 60° C. (140° F.). Lastly, having removed the benzoin, strain the lard, and stir occasionally while it cools. When benzoinated lard is to be kept or used during warm weather, 5 per cent (or more, if necessary) of the lard should be replaced by white wax"—(*U. S. P.*).

Action and Medical Uses.—Lard is emollient, and is a convenient article for the formation of ointments, plasters, and liniments. It is also used, without addition, to discuss *tumors*, by friction, or with cataplasm—(Ed.). Sometimes it is added to purgative injections. As an enema it is soothing in *colitis*. Being difficult of digestion it is occasionally used as a laxative for children. Good effects are obtained from it in inunction in *scarlatina* and other *eruptive diseases*, in which it allays itching and burning and improves the skin. Applied to the bridge of the nose with friction it alleviates the unpleasantness of *coryza*. When applied to *blistered* or *excoriated parts*, it will be apt to cause ulceration, unless it be free from rancidity. As a lubricating material for manual examinations and operations, it is preferable to petrolatum, as it does not readily mix with fluids. Many of the vegetable alkaloids are soluble in oleic acid (the red oil of soap and candle manufactories), and form with it useful and readily absorbed external applications.

ADEPS LANÆ HYDROSUS (U. S. P.)—HYDROUS WOOL-FAT.

"The purified fat of the wool of sheep (*Ovis Aries*, Linné; class *Mammalia*; order *Ruminantia*), mixed with not more than 30 per cent of water"—(*U. S. P.*).

SYNONYM: *Purified wool-fat.*

Source and Preparation.—Sheep's wool contains about 45 per cent of a fat known as *suint*, which must be removed from it before it can be made into fabric. This fat, which was formerly known and used as *œsypum*, contains a variable amount of potash, probably from 15 to 35 per cent. *Suint* is obtained by evaporating to dryness, wool-washings; and by proper chemical manipulation, the potassium salts, combined with organic acids taken from the soil by the animal while grazing, and eliminated in the perspiration and adhering to the wool, are separated; and it is estimated that thousands of tons of potash are yearly produced from this source alone. When first prepared, wool-fat consists of about one-third fatty acids in a free condition, besides certain fatty-acid ethers of cholesterin and glycerol. It is the cholesterin fats that enter into the commercial wool-fat. The process for making lanolin is secret. It has a characteristic, wool-like odor, is of a yellow-brown color, and though but partially dissolved by alcohol, dissolves readily in acetone, ether, chloroform and benzol. If this anhyarous wool-fat be now mixed, by kneading, with water, not more than 30 per cent, it forms the Pharmacopœial hydrous wool fat, or *Adeps lanæ hydrosus*.

Description and Tests.—"A yellowish-white or nearly white, ointment-like mass, having a faint, peculiar odor. Insoluble in water, but miscible with twice its weight of the latter, without losing its ointment-like character. With ether or chloroform, it yields turbid solutions which are neutral to litmus paper. Hydrous wool-fat melts at about 40° C. (104° F.). When heated on a water-bath, it finally leaves a residue amounting to not less than 70 per cent, which is transparent while melted, and, when cold, appears as a yellow, tough, unctuous mass, completely soluble in ether or chloroform, and only partially soluble in alcohol. A solution (1 in 50) of a portion of this mass in chloroform, when poured on the surface of concentrated sulphuric acid, gradually develops a deep-brown color at the line of contact of the two layers. When a portion of this mass is ignited, it should not leave more than 0.3 per cent of ash, which should not have an alkaline reaction on litmus (absence of alkalies). If 2 Gm. of the same mass are dissolved in 10 Cc. of ether, and mixed with 2 drops of phenolphtalein T.S., a colorless liquid results (absence of free alkalies), which should be decidedly reddened by 1 drop of normal potassium hydrate V. S. (absence of free fatty acids). If 10 Gm. of hydrous wool-fat be heated, together with 50 Cc. of water, on a water-bath, until the fat is melted, there should result an upper, translucent and light-yellow, fatty layer, and a lower, clear, aqueous layer, which latter should not yield glycerin upon evaporation, and, when a portion of it is heated with some potassium or sodium hydrate T.S., it should not emit vapors of ammonia"—(*U. S. P.*).

Chemical Composition.—Wool-fat is a mixture mainly composed of ethers of fatty acids, with cholesterin instead of glycerin as the basis.

Action and Medical Uses.—The use of sheep's wool-fat is ancient, and accounts of such employment are handed down by Pliny in his *Natural History.* It was reintroduced as a therapeutic agent by Liebreich, in 1885. It is employed as a non-irritating and efficient ointment base, and possesses marked advantages over like bodies in that it may be mixed with aqueous mixtures and glycerin. It will take up double its weight of water and of glycerin. Lanolin does not become rancid, nor does it leave the skin as soft and pliable as some emollient agents. Much contention has been had as to whether it is absorbed by the skin more than other fats, and as to whether it has any superiority in causing the absorption of drugs by the skin. Stellwagon, Liebreich, and others believe it to be absorbed more rapidly than any other fat. As it is a sebaceous secretion, it undoubtedly tends to favor normal action of the skin. It has been preferred alone as a protective in *mild affections of the skin*, and as an unguent for massage. As a vehicle for salicylic acid, boric acid, iodine and the iodides, and a number of other agents, it has been largely employed in a great variety of *cutaneous affections*.

Related Product.—THILANIN. *Thilanine, Sulphurated lanolin*, contains sulphur to the extent of 3 per cent. It is prepared by acting upon anhydrous wool-fat with sulphur, aided by heat. It has the consistence of hydrous wool fat, being a yellow-brown, unctuous body. It has been employed as a non-irritating dermic medicament. It is recommended for acute and subacute *eczema of the face, scaly eczema of the extremities*, and for the *papulo-vesicular* variety affecting the hands, as well as for other eczematous eruptions. *Sycosis, acne, herpes, psoriasis*, and *dermatitis* resulting from chrysarobin, are said to have been benefited by it. It is said to be particularly useful in *itching conditions*. It should be diluted with water or oils when applied to the scalp.

ADIANTUM.—MAIDENHAIR.

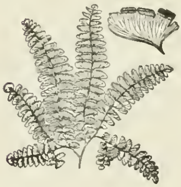
The whole plant of the *Adiantum pedatum*, Linné, and *Adiantum capillus Veneris*, Linné.

Nat. Ord.—Filices.

COMMON NAMES.—*Maidenhair, Maidenhair fern.*

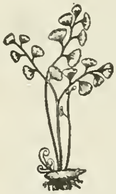
Botanical Source.—The American species of Adiantum is a delicately beautiful and graceful fern, growing from 6 to 15 inches high, with a handsome, polished, dark-purple or black stipe, forking at the summit; each branch so created supporting simple branches densely clothed with alternate, triangular, oblong pinnæ. These are entire and veined on their lower margin, incised on their upper border, and fruit-bearing. The fruit dots are short, slightly crescent-shaped, and marginal, and covered by an indusium derived from the reflected margin of the lobe. The fronds are erect and present a beautiful appearance. The leaves are slightly bitter, together with a faintly-sweetish, aromatic, feebly astringent taste. The odor is delicately aromatic.

Fig. 8.



Adiantum pedatum.

Fig. 9.



Adiantum capillus Veneris.

The European species is about 1 foot high, with a brownish or brownish-black stipe, pinnate above, and doubly or thrice pinnate below. The leaflets are irregular, wedge-shaped, obtusely incised, with the fruit dots in a marginal line. It is inodorous, with a sweetish taste, afterward slightly bitter, and feebly astringent.

History and Chemical Composition.—The maidenhair ferns contain a volatile oil, sugar, tannin, mucilage, and a bitter principle. The *A. pedatum* is a common fern in the moist, rich soil of the American woods, and is found also in Eastern Asia. The *A. capillus Veneris* is a native of Europe, but, according to Englemann, is naturalized in Florida, Texas, and Arkansas, and westward to California. The European species is used in preparing a syrup called *Sirop de capillaire*, which is popular in France and Germany as a mucilaginous pectoral. The plants yield their virtues to boiling water, and are used in decoction, infusion, or syrup.

Action, Medical Uses, and Dosage.—Maidenhair is refrigerant, expectorant, tonic, and subastringent. In decoction it forms an elegant refrigerant drink in *febrile diseases* and in *erysipelas*, and is also beneficial in *coughs, chronic catarrh, hoarseness, influenza, asthma*, etc. It is likewise reputed efficacious in *pleurisy*, and in *jaundice*. The decoction or syrup may be used freely. These plants are highly valued by some practitioners, and deserve investigation. Doses: Decoction (℥j to aqua Oj), dose, 1 to 4 fluid ounces. Infusion (℥j to aqua Oj), dose, 1 to 4 fluid ounces. Syrup (adiantum 1 part, boiling water 10 parts, sugar 19 parts; infuse, adding the sugar after the syrup has been strained), dose, 1 or 2 tablespoonfuls.

Related Species.—*Asplenium Adiantum nigrum*, Linné. *Black maidenhair*. Habitat, Europe. Mucilaginous. Substituted for the true maidenhairs.

Asplenium Trichomanes. *Spleenwort*. Europe. Also used to adulterate the true species. Neither of the foregoing have, however, the aromatic flavor of the genuine article.

Asplenium ruta muraria, Linné. *White maidenhair*. Indigenous to both Europe and the United States. Used for the same purposes as the medicinal fern.

ADONIS.—PHEASANT'S EYE.

The whole plant of *Adonis vernalis*, Linné.

Nat. Ord.—Ranunculaceæ.

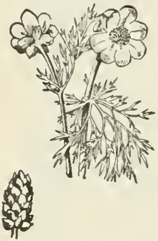
COMMON NAMES.—*Pheasant's eye, False hellebore.*

Botanical Source.—Adonis is a perennial herb growing from 12 to 15 inches high. The stem is branching, and the leaves many-cleft and sessile. The flowers are large, yellow, and attractive, with 10 or 12 oblong, spreading petals, slightly toothed at the apex. The fruit consists of numerous 1-sided acheniæ.

History and Chemical Composition.—This plant is indigenous to Southern Europe (being especially found in the Crimea) and to Siberia and Labrador. It is one of the very reliable spring flowers, and is found growing in elevated places. It was introduced into medicine by Dr. Bubnow (1879) as a cardiac stimulant. The doctor, who was a student under Prof. Botken, had observed its use by the Russian peasantry as a remedy for dropsy and heart diseases. Linderos (1876) obtained a yellow crystalline substance from the leaves and identified it as *aconitic acid* ($C_6H_6O_6$). In 1882, Prof. V. Cervello isolated its supposed active principle, which he named *adonidine* (*adonidin*). *Adonidin* is a crystalline, non-nitrogenous glucosid, odorless, colorless, and intensely bitter. Ether slightly dissolves it, while it is wholly soluble in alcohol and water. It is practically insoluble in benzol, chloroform, and turpentine. According to Podwissotzki, who has more recently (1888) investigated it, *adonidin* is a mixture composed of *adonitic acid*, *adonidoquercitrin*, *adonidodulcit*, and a couple of glucosids, one of which is the active constituent and named by him *picradonidin*. It is a very bitter, amorphous body, dissolving in alcohol, ether, and water, and said to be a powerful cardiac poison. Tannin precipitates adonidin from aqueous or ethereal solutions. Adonis root is frequently employed to adulterate black hellebore (*Helleborus niger*).

Action, Medical Uses, and Dosage.—Adonis acts very much like digitalis and strophanthus. It stimulates the muscles of the heart, thereby increasing cardiac contractility, and causes contraction of the smaller arteries throughout the whole body, thus increasing arterial tension. It diminishes the frequency of the pulse and regulates the heart-beat. The remedy acts quickly, even quicker than digitalis, and is well tolerated. Diuresis is increased, probably by its action on the renal circulation. Large doses paralyze both the heart and blood-vessels. Unlike digitalis, it is not cumulative. The drug should be cautiously used where there is gastro-intestinal inflammation. Adonidin in 3-grain doses every half hour, administered by mistake, produced violent vomiting and purging (Durand). Homœopathic physicians speak highly of this drug in *heart disease*, and *kidney affections*. Prof. E. M. Hale recommends its use in *endocardial inflammation*, with *valvulitis*. It is adapted to those cases where the cardiac muscles are laboring to overcome valvular obstruction, or when there is danger of dilatation of the heart from weakening of the muscular tissues. Prof. Hale also intimates that it is valuable in *secondary heart trouble*, resulting from *Bright's disease*, being indicated by an irregular and intermitting pulse, showing weakened heart action, with venous stasis and dropsy. It is valuable in *cardiac dropsy.* R Specific adonis, gtt. ij, every 2 or 4 hours. In *chronic albuminuria*, with scanty, light-colored urine and delirium, 5-drop doses greatly benefited the patient, and in another case it controlled *uremic convulsions*, which had been frequent, so that they did not again appear for two years, when the patient died (Wilcox). Prof. John M. Scudder said of it: "Its tonic action upon the heart is most marked." He recommended its use in *heart strain* from over-exertion. In one case its beneficial action was observed in one day. The remedy bids fair to take its place alongside of other drugs of the digitalis group in the treatment of all cases in which the latter are now so highly valued. Pallas attributes to the plant emmenagogue properties. The dose of the infusion (ʒj to aqua ℥xij) is a tablespoonful every 2 hours in severe cases; every 4 hours in chronic disease. Specific adonis, $\frac{1}{2}$ to 3 drops. Or, R Specific adonis gtt. x to xx, water ℥iv. Mix. Dose, 1 teaspoonful every 2 or 3 hours. Adonidin, $\frac{3}{10}$ grain every 3 or 4 hours.

Fig. 10.



Adonis autumnalis.

Specific Indications and Uses.—As a heart tonic, to be used when cardiac action is weak, with but little blood in the arterial system, with low pressure and shortened diastole, and consequent venous fullness and stasis with increased pressure, feeble, irregular, and intermittent pulse; valvular insufficiency, with regurgitation, and dropsy; vascular enfeeblement with passive, dull, congestive headache; chronic congestion.

Related Species.—*Adonis æstivalis*, Linné. Europe and Asia. An almost glabrous annual, having a bitter, acrid taste, but scarcely any odor. Its blossoms are of a yellowish-red hue. A remedy for *fatty heart.*

Adonis autumnalis, Linné. South Europe. Resembles the preceding in properties and appearance, except that it bears crimson blossoms. Both plants have the action and constituents of *Adonis vernalis.*

ÆSCULUS.—OHIO BUCKEYE.

The bark and fruit of the *Æsculus glabra*, Willdenow.

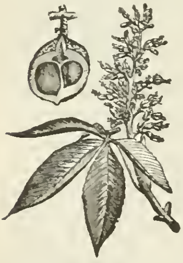
Nat. Ord.—Sapindaceæ.

COMMON NAMES.—*Ohio buckeye, Fetid buckeye, Smooth buckeye.*

ILLUSTRATION: Gray's *Gen. Illust.*, II, Pl. 177.

Botanical Source.—A small, fetid tree from 20 to 40 feet high, the leaves of which consist of five ovate, or oblong, serrulate, acuminate leaflets, somewhat hairy underneath. The flowers are small and yellowish, and borne in a loose thyrsoid panicle. Each flower has four petals about half the length of its stamens, which are seven in number and curved. The fruit is a prickly capsule, containing the seed.

Fig 11.



Æsculus glabra.

History.—The Ohio buckeye is found growing along streams and river banks in Ohio, Pennsylvania, Virginia, Kentucky, Indiana, north to Michigan and south to Mississippi. It flowers in May and June, and on account of the unpleasant odor given off the tree is often called fetid buckeye. The fruit contains an abundance of very fine starch, which it is surprising has not yet been introduced into commerce.

Description.—THE NUT (dry) of Æsculus glabra does not differ essentially from that of the horse-chestnut, except that it is darker in color, a little smaller in size, is perhaps somewhat more globular, and has a much smaller hilum, the latter being not more than one-third or less than one-half as large as that on the horse-chestnut. It ranges from $\frac{1}{3}$ to $\frac{1}{2}$ inch in diameter.

Chemical Composition.—(See *Hippocastanum* and *Gelsemium*).

Action, Medical Uses, and Dosage.—This agent influences the nervous and circulatory systems, having a selective affinity for the portal circulation. In over-doses it affects the cerebro-spinal system somewhat after the manner of nux vomica. Dizziness, fixation of the eyes, impairment of vision, vomiting, wryneck, opisthotonos, stupor, and tympanites are among its effects. In lethal doses these symptoms are increased, coma supervenes, and death finally takes place. The dried powder of the nut inhaled causes violent sneezing. The action of buckeye is similar to, but more powerful than that of the horse-chestnut (*Æ. Hippocastanum*), though some think it less powerful than the latter in its effects upon the portal circulation. It probably acts more powerfully on the spinal than upon the sympathetic nerves. When an excited circulation, with frequent pulse, depends upon disorders of the respiratory and sympathetic nerves, it acts as a decided sedative. The difficult breathing of *non-paroxysmal asthma*, where the dyspnœa is persistent, but does not amount to a paroxysm, is markedly benefited by æsculus glabra, while in *coughs*, associated with post-manubrial constriction—a sensation of grasping and tightening—its action is positive. The latter sensation without the cough quickly yields to it. *Phthisis*, *bronchitis*, etc., with dyspnœa and oppression, are palliated by it. *Intestinal uneasiness* and *irritation*, with a sense of contraction and colic-like pains in the region of the umbilicus, are indications for its use. It is asserted valuable in *intestinal dyspepsia* with these symptoms, and in *hepatic congestion* and *chronic constipation*. Its control over the portal circulation and its attendant disorders is pronounced, and as a remedy for *hemorrhoids* depending upon portal derangements, it has attained a reputation. A sense of constriction in the rectum is the guide to its use. In *female disorders*, with tumid and enlarged cervix uteri, with too frequent and profuse menstruation, it may be employed with advantage. Owing to its powerful action upon the nervous system the drug will repay study. It has been employed with asserted success in *rheumatism* and as a stimulant in *paralysis*. The dose of specific æsculus glabra is from 1 to 5 drops.

Specific Indications and Uses.—A sensation of grasping or constriction in the post-manubrial space, or at the supra-sternal notch; cough of spasmodic character, with but little expectoration; asthma, with continual dyspnœa, non-paroxysmal; tightness in the chest and about the heart; bronchial irritation with constriction; sense of constriction, tightness or uneasiness in the rectum, accompanied or not with hemorrhoids; intestinal irritation with constriction and colicky pains near the umbilicus.

Related Species.—*Æsculus pavia*, Linné. *Red buckeye*. United States. Southern states, from Georgia and Virginia westward. A small shrub; or in the vicinity of mountains, a tree. Coloring matter, tannin, resin, and a peculiar crystalline body, were obtained from red buckeye by Mr. Bachelor in 1873, from the testa of the fruit; and a green or brown fixed oil to the amount of 5 per cent, cane sugar, and a little over 2 per cent of a peculiar bitter, acrid, poisonous glucosid, of a brown color, were obtained from the cotyledons, which are principally starch. According to F. Peyre Porcher, M. D., the roots of this tree were preferred to soap for cleansing and whitening blankets, woolen goods, colored cottons, and satins. The fresh nut made into a paste with flour, and also the bruised twigs of the shrub, were used in the swamps of the Santee to stupefy fish, so as to cause them to float that they might readily be taken. A decoction of the nuts was recommended as a topical application to *gangrene*, and a strong decoction of the root held in the mouth was reputed a cure for *toothache*. An excellent starch, which does not become yellow with age, has been prepared from the fruit. It probably possesses the same properties as æsculus glabra.

Æsculus flava, Aiton. *Sweet buckeye, Large buckeye*. Western United States and mountains of the Appalachian system, from Virginia to Georgia. Grows from 6 to 70 feet high, and has yellow flowers.

Æsculus parviflora, Walter. *Small-flowered buckeye*. United States. Shrub, 2 to 9 feet high, with small, white flowers.

ÆTHER (U. S. P.)—ETHER.

FORMULA: $(C_2H_5)_2O$. MOLECULAR WEIGHT: 73.84.

SYNONYMS: *Æther fortior* (*U. S. P.*, 1880), *Sulphuric ether*, *Æther sulphuricus*, *Ethyl oxide*, *Hydrate of ethylen*, *Hydric ether*, *Naphtha vitrioli*, *Vinic ether*.

"A liquid composed of about 96 per cent, by weight, of absolute ether or ethyl oxide [$(C_2H_5)_2O$=73.84], and about 4 per cent of alcohol containing a little water"—(*U. S. P.*).

Preparation.—Sulphuric ether is prepared by the interaction of sulphuric acid and alcohol. From the latter, broadly considered, are thereby abstracted the elements of water, resulting in the formation of ether, as follows: $2C_2H_5OH-H_2O=(C_2H_5)_2O$. The process, however, is somewhat more complex, and takes place in two phases. It was determined and established by Williamson, in 1852. When alcohol and sulphuric acid are mixed, ethyl-sulphuric acid and water are formed. This ethyl-sulphuric acid being then heated to about 130° to 140° C. (266° to 284° F.) with a fresh portion of alcohol, is decomposed, ether being formed, and sulphuric acid regenerated. The reactions involved are expressed by the following formulæ:

$$C_2H_5OH+SO_4H_2=C_2H_5.SO_4H+H_2O.$$
$$C_2H_5.SO_4H+C_2H_5OH=(C_2H_5)_2O+SO_4H_2.$$

On this principle the present method of preparing ether is now carried out, known as the "continuous process" of Boullay. It consists in mixing together 2 measures of alcohol, specific gravity 0.830, and 1 measure of concentrated sulphuric acid; the mixture is submitted to distillation in a capacious retort, which must be connected with an efficient condenser. Through the tubulure of the retort a tube is introduced, which is in communication with a reservoir of alcohol, designed to maintain a supply of spirit sufficient to keep the amount of liquid at a uniform level in the retort during the course of subsequent distillation. The temperature is then rapidly raised so as to maintain the mixture in steady ebullition. The liquid which passes over consists almost entirely of ether and water, mixed with a small portion of alcohol which has distilled over unchanged. This process may go on without interruption until a quantity of alcohol, about thirty times as great as that originally taken, has become converted into ether. Isethionic acid is gradually formed in the residue.

The crude ether may be purified by agitating it with an equal bulk of water containing one-fortieth its weight of caustic soda in solution; the water combines with the alcohol, and the soda neutralizes any sulphurous acid that may have distilled over; the liquid separates into two layers, the upper one of which consists of ether, holding a little water in solution. The ether may be freed from water by allowing it to stand for a day or two upon quicklime, or upon chloride of calcium; it is then to be rectified by the heat of a water-bath, and condensed in vessels kept cool with ice-cold water. The purification of ether may be accomplished as directed by the *British Pharmacopœia*, a process yielding a better product than the old *U. S. P.* process: "Take of ether, distilled water, of each, 2 pints (Imp.); lime, recently burned, 1 ounce (av.); chloride of calcium, 4 ounces (av.). Put the ether with 1 pint (Imp.) of the water into a bottle, and shake them together; allow them to remain at rest for a few minutes, and when the two liquids have separated, decant off the supernatant ether. Mix this with the remainder of the water, and again, after separation, decant as before. Put now the washed ether, together with the lime and chloride of calcium, into a retort, to which a receiver is closely attached, let them stand for 24 hours, then distill with the aid of a gentle heat. Specific gravity not exceeding 0.720"—(*Brit. Phar.*).

Ether is obtained on a large scale, in the U. S. Naval Laboratory, by steam, as described by E. R. Squibb, M. D., in *Am. Jour. Pharm.*, 1856, p. 385. Squibb's ether is an exceptionally pure product, and is often preferred for anæsthetic purposes in this country.

Description.—The name "sulphuric ether," is a misnomer, at least as far as regards composition, there being no sulphur present. The *U. S. P.* describes official ether as "a transparent, colorless, mobile liquid, having a characteristic odor, and a burning and sweetish taste. Specific gravity 0.725 to 0.728 at 15° C. (59° F.); or 0.714 to 0.717 at 25° C. (77° F.). Soluble in about ten times its volume of water at 15° C. (59° F.), with slight contraction of volume. Miscible, in all proportions, with alcohol, chloroform, benzin, benzol, fixed and volatile oils. Ether boils at about 37° C. (98.6° F.), and it should, therefore, boil when a test-tube, containing some broken glass and half-filled with it, is held for some time in the hand. Ether is highly volatile and inflammable. Its vapor, when mixed with air and ignited, explodes violently"—(*U. S. P.*).

Pure ether, when freshly made, causes no alteration in the color of litmus or turmeric paper; but, by exposure, it absorbs oxygen, oxidizes slowly, and decomposes, yielding aldehyde, glyoxalic, acetic and formic acids. By evaporation, ether produces intense cold. Pure ether dissolves one eightieth of its weight of phosphorus; but if it contains alcohol, only one two-hundred-and-fortieth; it also dissolves a very small portion of sulphur, bromine, and iodine, but the solutions of the latter decompose by keeping. It abstracts bichloride of mercury, chloride of gold, bichloride of platinum, and the perchloride of iron, from their watery solutions. It dissolves most resins, pyroxylic spirit (wood alcohol), many fats, volatile oils, gallic acid, many of the vegetable alkaloids, urea, gun cotton, chromic acid, oleates of heavy metals, tannic and many other organic acids, caoutchouc, phosphorus, bromoform, chloroform, iodoform, benzin, benzol (benzene), alcohols, iodides, bromides, chlorides, and some sulphides of metals.

M. Grimault has given a method by which pure ether may be gelatinized, or, if required, various substances may be dissolved in it, as camphor, cyanide of potassium, morphine, conine, etc. If 4 measures of pure ether are added to 1 measure of white of egg, and the mixture be briskly agitated, the albumen will soon be seen to swell, and absorb the entire ether, forming a thick collodion, which soon becomes an opaline, trembling jelly, and does not separate into the two ingredients of which it is composed. Applied to the skin and covered with a band of cloth, or caoutchouc, it speedily causes redness without vesication; and when it begins to dry, a new layer may be applied if necessary. If the mixture be exposed to a water-bath at 70° C. (158° F.), an almost instantaneous solidification is obtained without the separation of ether.

"Ether should be kept in well-stoppered containers, preferably in tin cans, in a cool place, remote from lights or fire"—(*U. S. P.*). It has also been shown by Schönbein that pure ether changes its properties when in contact with air or oxygen, and exposed to diffused light. Under these conditions, hydrogen peroxide, ozone, aldehyde, and ethyl peroxide, are liable to be formed, and may become the cause of dangerous, spontaneous explosions (Krauch). There are in commerce, varieties known as "concentrated ether," and "washed ether." They should not be employed either in medicine or pharmacy, in consequence of their uncertain composition. The virtues of many agents containing vegetable oils and resins, may be taken up by ether in the form of tincture, when, by evaporating the ether, the desired active product is left behind; this is the case with lobelia seeds, capsicum, scutellaria, podophyllum, ptelea, stillingia, xanthoxylum berries, iris, and several other preparations.

Tests.—Ether may be recognized by its striking physical properties, especially its peculiar odor and taste, its complete solubility in alcohol, and its sparing solubility in water. If a mixture of ether and water produce a white color, oil of wine is present; the ether may be separated by distillation at a gentle heat. Absolute ether does not dissolve aniline-violet, according to Stephanelli, but gives a decided coloration if but 1 per cent of alcohol be present. The *U. S. P.* directs the following tests: "The color of light-blue litmus paper moistened with water, should not be changed when the paper is immersed in ether for ten minutes. Upon evaporation, ether should leave no residue. If 10 Cc. of it be poured, in portions, upon clean, odorless blotting paper, and allowed to evaporate spontaneously, no foreign odor should become perceptible when the last traces of ether leave the paper. When 20 Cc. of ether are shaken in a graduated tube, with 20 Cc. of water, just previously saturated with ether, the ethereal layer, upon separation, should not measure less than 19.8 Cc. (absence of an undue amount of alcohol or water). If 10 Cc. of ether be shaken occasionally, within one hour, with 1 Cc. of potassium hydrate T.S., no color should be developed in either liquid (absence of aldehyde, etc.)"—(*U. S. P.*).

Action and Toxicology.—Ether taken by mouth has at first a sweetish taste, followed by great heat and pungency. In moderate doses it acts powerfully on the mouth, throat, and stomach, allays spasm, and relieves flatulence, without increasing arterial action. After the burning in the stomach has subsided, a cooling sensation, quickly diffusing itself throughout the system, is experienced. It first excites the cerebral functions, then depresses. In somewhat larger doses it causes intoxication. The heart's action is increased, the face becomes flushed, the surface warm, and in a very short time sweating takes place, similar to, yet less transient than that from alcohol, and quickly followed by a sense of contentment and mental quietude, associated with a desire to sleep. Seldom does its effect last more than 1 hour, even when 2 fluid drachms have been swallowed. Individuals may become so accustomed to taking ether that large quantities may be consumed in a day. Intoxication from ether drinking is reported common in Ireland (*British Med. Jour.*, 1890). Life has not been directly destroyed by ether as a *fluid*, but several deaths have resulted from inhalation of the *vapor*. (For the effects of inhalation, see *Etherization*). In very large doses it causes nausea, increased flow of saliva, giddiness, and suspension of sensation and voluntary motion. Locally applied, it produces rubefaction, and sometimes vesication, if its evaporation be prevented; but it acts as a refrigerant, occasioning a great degree of cold, when suffered to evaporate.

Medical Uses and Dosage.—Ether is narcotic, stimulant, antispasmodic, refrigerant, and carminative. Its antispasmodic and stimulating properties render it efficient in *spasmodic asthma*, *flatulent colic*, *hiccough*, *subsultus tendinum*, *cramp of the stomach*, *nervous headache*, *sick headache* attended with double vision, *photopsy*, and *nausea* or *vomiting*, *lowness of spirits*, *gastrodynia*, *hysteria*, *dyspnœa*, *palpitation*, and *gout of the stomach;* it is also efficacious to overcome the painful spasms occasioned by *urinary* or *biliary calculi*, during their passage through the ducts or tubes; for this purpose it is frequently conjoined with oil of turpentine. As an antispasmodic, it will be found useful in all forms of spasmodic action, unattended by inflammation, as *chorea*, *epilepsy*, *tetanus*, etc.

On account of its emulsifying properties when combined with fatty matter, as codliver oil, ether has been used to aid digestion, and tissue production, in *phthisis*. By stimulating the gastric and duodenal tracts, it secondarily influences the pancreatic secretion, which then readily acts upon the emulsified oil, making its digestion more perfect, and thereby adding to the nutrition of the body.

When applied locally, as a refrigerant, allowing it to evaporate, ether is useful in *nervous* and other *headaches*, in *external inflammations*, *strangulated hernia*, etc. As a rubefacient, it may be employed in all cases where this effect is indicated, by checking its evaporation. The spray of ether, directed upon painful parts, has been used as a local anæsthetic, as well as for minor surgical operations. Sprayed upon the lumbar region, it eases the pains of *labor;* and uterine contraction, with the control of hemorrhage, may be accomplished by spraying it on the lower part of the abdomen. Applied by vapor, or upon a pledget of cotton, it relieves *earache*, and combined with camphor and inserted into carious dental cavities, it controls *toothache*. *Pediculi pubis* are destroyed by it, and it is fatal to *ascarides* when used by rectal enema. Ether has been subcutaneously injected in *sciatica*, *lumbago*, and other *neuralgias*, in *sudden syncope*, and in the prostration following pulmonary and post partum *hemorrhages*, *convulsions*, and in *chloral* and *opium poisoning*, etc. The quantity injected should be from 10 to 15 minims, and care should be had not to inject deeper than the fascial tissues. When 1 fluid ounce of pure ether is well agitated, in a closed bottle, with 2 fluid drachms of white of egg, a tremulous jelly is formed, termed *gelatinized ether*, which may be spread on cloth and applied upon painful parts, to act as an anæsthetic. It should be covered with a compress or some body to prevent too rapid evaporation; and, on account of its want of permanency, should only be made when required for use.

The dose of ether varies from 10 to 60 drops, which should be repeated at short intervals. It may be given in water by triturating it with a little spermaceti; and is frequently combined with opium, ammonia, or valerian. *Capsules of ether*, or *pearls of ether* (Clertin), are prepared by inclosing 5 or 6 minims of pure ether in capsules made of gum and sugar; they afford a very pleasant and efficacious mode of administering this fluid. They should be freshly prepared every 10 or 12 months, as they part with their ether. Lortet has found these capsules useful in *tænia*. He gives at one dose 2 ounces of ether, followed in two hours by 1 ounce of castor oil.

Etherization.—Ether (formerly under the name of *Letheon*) is very extensively employed as an anæsthetic agent, for the prevention and removal of pain and spasm, and whenever severe operations are about to be performed. While equally as efficient as chloroform, it is less pleasant to inhale, and not quite so rapid in producing anæsthesia. It is, however, much safer than chloroform, as death, when produced, results from respiratory paralysis, the heart continuing to beat after respiration has ceased. Such being the case, when respiratory action fails, artificial respiration may be resorted to, whereas, with chloroform, death is produced mainly by cardiac paralysis, which is further beyond the power of the physician to remedy. Not more than 3½ per cent of chloroform should be present in the inspired air, whereas the air may contain from 60 to 70 per cent of ether with safety. It occasions vomiting less readily than chloroform. On the other hand, it is very inflammable and cannot be so well used near lights, as is sometimes required in obstetric practice. Here chloroform is to be preferred. Ether was the first agent to be used, as a general anæsthetic by inhalation, for the performance of great surgical operations. Under partial anæsthesia, Dr. John C. Warren, at the request of a Boston dentist, Dr. W. T. G. Morton, performed a severe surgical operation at the Massachusetts General Hospital, Oct. 15, 1846. On the succeeding day, Prof. Hayward operated upon a patient under full anæsthesia. Dr. C. T. Jackson, of Boston, at once informed Dr. Warren that he had first imparted to Morton a knowledge of its value in the painless extraction of teeth, which was the use Dr. Morton had made of it.

The phenomena produced by the inhalation of this anæsthetic are mainly as follows: When first inhaled, some faucial irritation is produced, as well as cough and shortness of breath. The extremities prickle; exhilaration, with talkativeness, or laughing, crying, praying, or raging, with a sense of lightness, is felt, and gradually all the senses are blunted or perverted, that of pain being lost before that of touch. This is a good stage for slight operations, and for midwifery emergencies. Gradually consciousness is lost, and gradual muscular relaxation, sometimes preceded by tetanic rigidity, takes place. The circulation and respiration are quickened, though the latter is somewhat shallower than when normal; warmth of skin with perspiration ensues, as well as contraction of the pupil. Continuing the inhalation, complete insensibility and muscular relaxation take place, the breathing becomes slow, deep, and even stertorous, the pulse slow and feeble, the pupil dilated, the cutaneous surface moist, cool, and livid or cyanotic. Stertorous breathing is the signal for withdrawing the anæsthetic, for then respiratory paralysis is approaching. The best stage for operating is that when muscular relaxation is complete, so that the arm, if lifted and dropped, will fall helpless, and when the conjunctiva may be touched without flinching on part of the patient. As to the method of administration, it may be used in a similar manner to that for inhaling chloroform (see *Chloroformum*); about from 4 to 6 minutes will be required before anæsthesia occurs, the patient generally inhaling the vapor from 1½ to 2 fluid ounces of the liquid; it should be used in small quantities at a time, and any depression of the pulse, or spasmodic symptoms, and particularly stertor, occurring during its inhalation, indicate danger, and its further inhalation should be discontinued. Artificial respiration, stimulants, cold water to the head and spine, electro-magnetism, etc., are the means to overcome its unpleasant effects. To produce anæsthesia, chloroform is more commonly preferred, as it is pleasanter and more easily administered. For some time the *A. C. E. Mixture* (1 part of alcohol, 2 parts of chloroform, and 3 parts of ether) was quite popular, but is now comparatively seldom employed. The practice of frequently inhaling ether, is dangerous, often causing inflammation of the brain, or insanity.

A peculiarity of ether inhalation, is the disposition to use indecent language and to say things of which the patient is afterwards heartily ashamed. Thus, the patient may become amorous, pugnacious, lascivious, or vulgar, and may reveal long-kept secrets. Roaring, and rushing sounds of wind, or rushing water, hysterical phenomena, cerebral and pulmonary congestion, acute nephritis, and even mania, may follow its use. Vomiting often occurs as an after-effect, and is quite persistent. Ether may be employed to anæsthetize patients about to undergo *surgical operations*, no matter how severe, and either it or chloroform is now universally employed for this purpose. Being adapted to the whole range of operations, it is unnecessary to enumerate them here. Not only is it used to produce anæsthesia and analgesia, but to overcome spasm and muscular resistance. For the latter purpose, it is of great value as an aid in reducing *luxations* and *fractures*. To mitigate the pangs of *labor* it is useful, but chloroform is preferable, as its vapor is not inflammable, and it may be used near lights. Besides the majority of the conditions for which it is internally given (see above), it may be inhaled for the relief of *dysmenorrhœa*, *hydrophobia*, *puerperal* and other *convulsions*, *whooping-cough*, *laryngismus stridulus*, *croup* (spasmodic), *mania*, *delirium tremens*, etc. In *puerperal eclampsia*, it should be used to control convulsive action until appropriate remedies may be given. In the *hysteria* following child-birth, it is an excellent antispasmodic, as well as in *infantile convulsions* not depending "upon a morbid irritability of the nervous system with organic change" (Locke). Distressing *after-pains* are safely and quickly overcome by a few whiffs of ether, and the same procedure relieves *nervous headache*. *Lead colic* is relieved, both by the rectal enema of ether and by its inhalation.

Specific Indications and Uses.—Pain, or convulsive action, with feeble circulation, and cool, pallid face; headache, with enfeebled circulation. To produce anæsthesia, for the performance of surgical, gynecological and obstetrical operations.

ÆTHER ACETICUS (U. S. P.)—ACETIC ETHER.

FORMULA: $C_2H_5C_2H_3O_2$. MOLECULAR WEIGHT: 87.8.

SYNONYMS: *Ethyl acetate*, *Naphtha aceti.*

"A liquid composed of about 98.5 per cent, by weight, of ethyl acetate [$C_2H_5C_2H_3O_2=87.8$], and about 1.5 per cent of alcohol containing a little water" —(*U. S. P.*).

Preparation.—Formerly, acetic ether was prepared by distilling a mixture of acetate of lead, sulphuric acid, and alcohol. At present, however, sodium acetate is generally employed instead of the lead salt. For this purpose it is previously deprived of its water of crystallization by the application of heat. The reaction takes place according to the following equation:

$$CH_3.CO_2Na+H_2SO_4+C_2H_5OH=CH_3CO_2C_2H_5+HNaSO_4+H_2O.$$

The process of the *British Pharmacopœia* is as follows: "Take of rectified spirit, 32¼ fluid ounces (Imp.); sulphuric acid, 32½ fluid ounces (Imp.); acetate of sodium, 40 ounces (av.); carbonate of potassium, freshly dried, 6 ounces (av.). To the spirit slowly add the acid, keeping the fluid cool, and, the product being cold, add the acetate, mixing thoroughly. Distill 45 fluid ounces (Imp.). Digest the distillate with the carbonate of potassium for three days in a stoppered bottle. Separate the ethereal fluid, and again distill until all but about 4 fluid ounces have passed over. Preserve the resulting acetic ether in a well-closed bottle, and in a cool place"—(*Brit. Phar.*).

Description and Tests.—Acetic ether, as required by the Pharmacopœia, is "a transparent, colorless liquid, of a fragrant and refreshing, slightly acetous odor, and a peculiar acetous and burning taste. Specific gravity, 0.893 to 0.895 at 15° C. (59° F.). Boiling point, about 76° C. (168.8° F.). Soluble in about 8 parts of water at 15° C. (59° F.); miscible, in all proportions, with alcohol, ether, fixed and volatile oils. Acetic ether is readily volatilized, even at a low temperature. It is inflammable, burning with a yellowish flame and an acetous odor. It is neutral to litmus paper. When evaporated in a capsule, acetic ether should leave no residue. If a portion be allowed to evaporate spontaneously from clean, odorless blotting paper, the final odor should not resemble that of pineapples (absence of butylic and amylic derivatives). When 25 Cc. of acetic ether are shaken, in a graduated tube, with 25 Cc. of water just previously saturated with the ether, upon separation, the ethereal layer should not measure less than 24.5 Cc. (absence of an undue proportion of alcohol or water). When a small portion of the ether is carefully poured upon some concentrated sulphuric acid, no dark ring should be developed at the point of contact of the two layers (absence of readily carbonizable, organic impurities)"—(*U. S. P.*).

Acetic ether is decomposed by acids and alkalies. When it burns, acetic acid is developed during the combustion. Acetic ether is always present in small quantity in wine vinegar, which owes its flavor to this compound. It is a good solvent for the essential oils, resins, pyroxylin, cantharidin, and other substances; mixed with an alcoholic solution of caustic potash, the mixture is immediately decomposed into acetate of potassium, and alcohol. Acetic ether readily dissolves chloride of calcium, and forms a crystallizable compound with it, which yields the ether unchanged on the application of heat. One part of acetic ether, and

3 parts of alcohol (80 per cent), form the *Spiritus Aceticus Æthereus.* Sulphur and phosphorus are both very slightly soluble in this liquid. Though not so inflammable as ether, it should not be kept near fire or lights. It should always be kept in a dark, cool place, in closely-stoppered bottles. In contact with the atmosphere, especially if moisture be present, free acetic acid will be produced. Acetic ether was first made, in 1759, by Lauraguais, who, to produce it, distilled alcohol with concentrated acetic acid.

Action, Medical Uses, and Dosage.—Acetic ether is somewhat similar in its operation to ether, but is milder, more agreeable, and more diaphoretic. It has been used in *nervous fevers, putrid fevers, cardialgia, spasmodic vomiting,* and *asthenic affections of the stomach and bowels.* By inhalation, it relieves *nervous excitation, nervous coughs,* and *syncope.* Dose, from half a fluid drachm to 2 fluid drachms, in a sufficient quantity of water. This agent is less volatile and less inflammable than sulphuric ether.

Related Preparation.—ÆTHER FORMICICUS. *Formic ether, Æther formicus.* Formula: $C_2H_5CHO_2$. Molecular Weight: 73.83. Bucholz produced this ether in 1782. It is prepared by mixing with 88 per cent alcohol (7 parts) dry formate of sodium (8 parts), adding to the mixture in the retort concentrated sulphuric acid (11 parts); this creates sufficient heat to disengage the formic ether. If the distillate be acid, an equal quantity of water, holding in suspension magnesia or lime, should be added to it, and the mixture shaken. Finally, it should be treated with calcium chloride, from which it may be rectified.

Formic ether has a specific gravity of 0.918 at about 17° C. (62.6°F.), and boils near 55.5° C. (132° F.). It is a limpid, colorless liquid, with a powerful odor, recalling that of bitter almonds. To the taste it is pungent. It is freely soluble in alcohol, wood alcohol, volatile and fixed oils, and sulphuric ether, and less soluble in water (1 in 10). It is inflammable, and should be cautiously used near fire and lights. This agent markedly reduced the temperature (3½° C.) in animals, with signs of asphyxiation, and relaxation of the muscles, and anæsthesia. In man, only symptoms of drowsiness were produced by 90 to 105-grain doses (Byasson). It seems to be eliminated by the kidneys.

ÆTHER METHYLICUS.—METHYL ETHER.

FORMULA: $(CH_3)_2O$. MOLECULAR WEIGHT: 45.90.

SYNONYMS: *Methyl oxide, Methoxylmethane, Methylic ether, Methylene hydrate.*

Preparation.—This substance is produced by abstracting the elements of water from methyl alcohol: $2CH_4O-H_2O=C_2H_6O$. It is prepared by heating a mixture of 1.3 parts of pure methylic alcohol and 2 parts of sulphuric acid, in a flask, gradually raising the temperature to 140° C. (284° F.). The gas is washed by passing it through a solution of caustic soda (*Chem. News,* Vol. 30).

Description.—Methyl ether is a colorless gas, with an ethereal odor. It burns with a pale flame. Its specific gravity is 1.617, referred to air, or 23, referred to hydrogen, as the standard of unity. One great objection to it as a popular remedial agent, is the fact that it is gaseous at ordinary temperatures. Water dissolves 33 times its volume. Alcohol and methyl alcohol dissolve it more freely, while sulphuric acid will dissolve 600 times its volume, with increase of temperature. In the latter case, the gas is freely liberated upon the addition of water.

Action and Medical Uses.—This gas, taken up to saturation, by concentrated ethylic ether, at a temperature of 0° C. (32° F.), forms the anæsthetic fluid of Dr. B. W. Richardson, of England—methyl-ethylic ether. This compound, however, must not be confounded with that known also as methyl-ethyl ether, or methyl-ethyl oxide (see *Related Compounds,* below). As it is very volatile and highly inflammable, it should be at once placed into well-secured bottles and kept in the cold. According to Dr. Richardson, it is a rapid and perfectly safe anæsthetic, and more closely approximates what a true agent of this kind should be than any other yet presented to the profession. A drachm or two inhaled, effects anæsthesia quickly. It simply destroys sensibility, without interfering with will, consciousness, or muscular power, and without occasioning spasm, syncope, asphyxia, or any excitation of the nerve centers (*Lancet,* April 2, 1870). In consequence, however, of the instability of this preparation, and its by no means agreeable odor, it has not come into general use as an anæsthetic.

Related Compounds.—ÆTHER METHYL-ETHYLICUS, *Methyl-ethyl oxide, Methyl-ethyl ether.* This compound is produced by the interaction of methylate of sodium and iodide of ethyl, the vapors from the retort being passed through a weak solution of soda, at a temperature of about 15° C. (59° F.) by which volatile impurities are separated, and the product condensed in cold receivers. It forms an exceedingly inflammable, colorless fluid, of an odor peculiar to itself. It boils at 11° C. (51.8° F.). It has had a limited use as an anæsthetic, and must not be confused with Richardson's anæsthetic, known by the same name—methyl-ethylic ether.

METHYLAL ($CH_2[OCH_3]_2$), *Methylen-dimethyl ether.* This compound is the result of the action of a mixture of sulphuric acid and dioxide of manganese on methyl alcohol, and rendered pure by fractionally distilling the crude substance, and employing means to abstract therefrom the elements of water. It forms a limpid, colorless fluid, having a pungent, ether-like odor. It dissolves in water (1 in 13), alcohol, fixed and essential oils, and in ether. It is unaffected by alkaline bodies, but is decomposed by sulphuric acid. Its density is 0.855; its boiling point about 42° C. (106.6° F.). It was proposed by Dr. B. W. Richardson as a narcotic and anæsthetic. It has also been employed to relieve painful and spasmodic affections, as *colic, angina pectoris, asthma, intestinal neuralgia,* and *tetanus.* It has been successfully employed as a hypnotic for the *insane.* It may be given in ʒj or ʒjss doses in water or syrup, or orange flower water, largely diluted. It is but little used.

ÆTHYL BROMIDUM.—BROMIDE OF ETHYL.

FORMULA: C_2H_5Br. MOLECULAR WEIGHT: 108.69.

SYNONYMS: *Hydrobromic ether, Monobromo ethane, Æther hydrobromicus.*

Source and History.—Bromide of ethyl was discovered by Serullas, in 1827, who made it by acting upon phosphorus with bromine, in contact with alcohol. In 1852, Mr. E. Robin experimented upon birds with this agent, and was pleased with its action as an anæsthetic. He stated that it produced rapid effects, without any subsequent suffering or distress. In 1865, Dr. Nunnelly experimented further; and afterward, Dr. Rabuteau (1876) made some careful investigations regarding its action; while still more recently, Drs. Lawrence Turnbull and R. J. Levis, of Philadelphia, have brought the agent prominently before the medical profession, and to them belongs the credit of its more recent introduction into medicine.

Preparation.—The original process for making bromide of ethyl was troublesome and dangerous. It was improved upon by De Vrij, bromide of potassium being decomposed in contact with alcohol, by means of sulphuric acid. This is the favored process at the present day, and we call attention to the two practical modifications of it given in the *Amer. Jour. Pharm.*, May, 1880. The articles were written by Lawrence Wolff, M. D., and Prof. Jos. P. Remington. We prefer that of Prof. Remington (given below), from the fact that he adds the alcohol slowly to a warmed mixture of the sulphuric acid, water, and bromide of potassium, although the formula of Dr. Wolff will give satisfactory results.

Take of bromide of potassium, in crystals, 58 parts; sulphuric acid, 44 parts; alcohol, 44 parts; water, 28 parts. Introduce the mixed water and sulphuric acid (observing precautions regarding mixing sulphuric acid and water, given in article on *Hydrobromic Acid*) into a tubulated retort of 116 parts capacity, and when the mixture has become cool, add the bromide of potassium. Then place the retort on a sand-bath, and fix in its tubulure a funnel-tube, and connect the exit with a condenser; heat the mixture to 116° C. (240.8° F.), and then slowly supply alcohol until the 44 parts are consumed. The heat, during the reaction, must be maintained between 100° C. (212° F.) and 116° C. (240.8° F.), and be continued after the alcohol is added, until it reaches 116° C. (240.8° F.), when the operation must be discontinued. The distillate, crude ethyl bromide, must be very carefully purified, as follows: Mix it with an equal bulk of distilled water, previously rendered distinctly alkaline with caustic soda or caustic potash, and agitate the mixture violently. After it has separated into two layers, marked by a clear line of demarcation, siphon the lower liquid into a retort, add a little chloride of calcium, and distill the mixture upon a water-bath. This distillate must be redistilled from a clean retort, by means of an expanded steam- or water-bath.

Description.—Bromide of ethyl is transparent, colorless, volatile, has an agreeably ethereal odor, and a penetrating, sweetish taste. It is not inflammable, neither will it explode. Its specific gravity is 1.420 (Remington), and its boiling point 40° to 41° C. (104° to 105.8° F.). It dissolves freely in alcohol and ether, but is comparatively insoluble in water. It should, in all cases where intended for use as an anæsthetic, be perfectly volatile at ordinary temperatures, and, when evaporated from a clean glass or porcelain plate, by exposure, it should not leave a stain, and the plate should be devoid of all odor.

Action and Medical Uses.—We have noticed the remarks of Drs. Lawrence Turnbull, and R. J. Levis, of Philadelphia, Pa., relative to the safety and efficacy of ethyl bromide as an anæsthetic. These gentlemen have employed this agent in a great number of cases without any serious accident occurring, and consider it fully as safe an anæsthetic as ether, decidedly more so than chloroform, and superior to either; but a pure article must always be employed. Dr. Levis states that its action is rapid, and that the patient quickly recovers from its effects. Its vapor is non-inflammable, and not irritating to the respiratory passages, influencing respiration but slightly, if at all; the circulation is not affected by it, except sometimes a slight augmentation in the rapidity of the heart's action, and perhaps a trifling increase of arterial tension or pressure. Nausea and vomiting are said to occur less frequently (more liable, according to Agnew, Terillon, and others) than with ether or chloroform, and its inhalation does not occasion cerebral anemia, or fatal syncope from cardiac depression, so frequently following the employment of chloroform. Clinically, several disasters have followed its use, and it is now practically abandoned. *Minor operations* have been performed under its use as a local anæsthetic, applied with an atomizer.

Related Product.—ETHYLENE BROMIDE $(C_2H_4Br_2)$ This substance must not be mistaken for *Bromide of ethyl.* It is prepared by the direct combination of ethylene gas (olefiant gas), with bromine. It is a pale-brownish fluid, sweet, with a burning after-taste, and an odor not unlike that of chloroform. At 0° C. (32° F.) it congeals as a snow-like mass of crystals. It boils at 131° C. (267.8° F.). It possesses feeble and slow anæsthetic qualities. Inhalations of it may poison. *Epilepsy* has been successfully treated with it.

ÆTHYL IODIDUM.—ETHYL IODIDE.

FORMULA: C_2H_5I. MOLECULAR WEIGHT: 156.

SYNONYMS: *Æther hydriodicus, Hydriodic ether, Iodide of ethyl.*

Source and History.—This preparation is now made by distilling a mixture of amorphous phosphorus, iodine and alcohol. Gay-Lussac (1815) was the first to prepare it, producing it by distilling hydriodic acid and absolute alcohol, and setting the ether free with water.

Preparation.—When ordinary phosphorus is employed, the process is as follows: Take 10 parts of iodine, 5 parts of absolute alcohol, and 1 part of phosphorus. Place the alcohol in a retort and add a small amount of iodine; then add a small quantity of the phosphorus, from time to time, until the liquid becomes colorless; a fresh portion of iodine is then added, and then a fresh quantity of phosphorus, and so continued until all the iodine and phosphorus have been added. Cool the mixture thus obtained by immersing the bulb of the retort after each addition, in cold water, to moderate the action. After the reaction has terminated, the liquid is to be distilled by the heat of a water-bath, taking care that the iodine (as shown by its brown color) is in slight excess. The distillate should be washed with water, treated with chloride of calcium, and redistilled. The use of amorphous phosphorus, as suggested by Personne, in 1861, is now generally adopted, the proportions used, and the procedure, being practically the same as indicated for ordinary phosphorus, except that the mixture of alcohol, phosphorus, and iodine, is allowed to stand for 24 hours to complete the reaction.

Description.—Hydriodic ether is colorless, and has no acid reaction. Its odor is ethereal, its taste pungent, but less sharp than that of sulphuric ether. Its density is 1.9206 at 22.2° C. (72° F.); it boils at 71.1° C. (160° F.), and is not inflammable. When thrown on burning coals, it expands in purple vapor. It is not decomposed immediately by potassium hydroxide, nor by nitric or sulphurous acids, but sulphuric acid decomposes it, and sets free a part of the iodine. The action of the air discolors it slightly, by liberating a little iodine, which may be readily removed by the alkalies, or mercury, a globule of which, thrown into the vial, is sufficient to retain the ether in a state proper for inhalation. Its density admits of its being kept under water, in which it is practically insoluble; but it is soluble in alcohol.

Action, Medical Uses, and Dosage.—The physiological effects of this ether are stated to be: "After some inhalations, an impression of calmness and satisfaction announces that the hydriodic ether acts at first conformably with the sedative properties of the other ethers employed in medicine. The respiratory motions are carried on with readiness and fullness, advantageous to the circulation; but the antispasmodic action of the ethereal vapor, which favors the absorption of the remedy, is soon followed by the influence of the absorbed iodine. The increase of vigor ceasing to be limited to the thoracic muscles, extends to the muscular system. The appetite is developed, the secretions are increased, the genital feelings become more sensitive, the pulse acquires fullness, and the vivacity of the feelings, and the activity of the intellect, prove that the impulse given to the other organs extends to the brain also. Such are the effects that 4 daily inhalations, of 10 minutes each, produced on Dr. Huette. As to accident, he never experienced anything but a little coryza, and frequently, when the vapor had been too concentrated, a slight feeling of pressure in the temples."

He thinks that in many cases there will be an advantage in substituting the inhalation of hydriodic ether for the other preparations of iodine, observing that inhalation permits the fractioning of the doses to any extent, and causes the absorption of the medicine by more extended surfaces, more generally accessible in all their parts, and better calculated for the absorption of the smallest medicinal atoms, than are the digestive organs (*Am. Journ. Pharm.*, xxiii., 156). It has likewise been advantageously employed in inhalation by several physicians of this country in chronic diseases of the air passages, especially in *membranous phthisis* and *bronchial affections.* It is comparatively safe as a medicinal agent.

Ethyl iodide is a powerful anæsthetic when inhaled, but it must be entirely free from phosphorus. It is a most valuable remedial agent, patients being able to bear a much larger quantity of iodine in this form than they possibly could bear in any other manner. It has been used internally with success in *scrofulous diseases*, by inhalation in *diseases of the lungs* and *heart*, and as a local application to *painful* and *irritable ulcers*, and *scrofulous ulcers.* Hydriodic ether is recommended by Dr. Huette, by way of inhalation, as a remedial agent in several diseases, especially in *pulmonary consumption, tubercular affections* in many parts of the body, and where it is desired to saturate the system quickly with iodine. It appears likely to play an important part in medicine. Fifteen to 30 grains of the hydriodic ether are transferred, by means of a graduated pipette, into a little ground-stoppered bottle (3 or 4 Cc.) 1 to 1½ inches high. The ether is covered with a stratum of water about 2 or 2½ Mm. thick, the object of which is to moderate the evaporation; when the vial is applied to one of the nostrils, and the air contained within it is drawn by an inspiration. The ethereal vapor is sufficiently diluted with air before reaching the lungs. The evaporation of the ether may be accelerated by inclining the vial to one side, so that the continuity of the watery layer may be broken, and the heat of the hand may be applied to the same object. Fifteen or 20 inspirations suffice for the impregnation of the system with iodine, and a quarter of an hour after the cessation of the inhalations, iodine is found in the urine; and has also been found present 50 or 60 hours afterward. Some prefer to have it in glass capsules, or "pearls," which hold 10 or 15 minims, and may be crushed in the handkerchief and inhaled.

ÆTHYLENI BICHLORIDUM.—ETHYLENE BICHLORIDE.

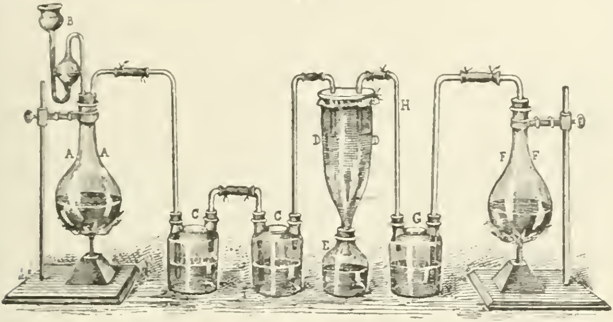
FORMULA: $C_2H_4Cl_2$. MOLECULAR WEIGHT: 98.68.

SYNONYMS: *Æthylenum chloratum, Liquor Hollandicus, Elaylum chloratum, Dutch liquid, Ethene chloride.*

Source and History.—In 1795, four associated Dutch chemists discovered that when 1 measure of alcohol was mixed with 3 of sulphuric acid, and heat applied, a gas was evolved, named by them *olefiant gas* (now known as ethylene or ethene), from its property of forming an oil-like liquid with chlorine. This liquid, for many years recognized under the name *Dutch liquid*, is ethene chloride, or bichloride of ethylene.

Preparation.—To prepare it, connect a 32-ounce chemical flask, A (Fig. 12), furnished with a safety funnel, B, by means of glass tubes, with two 8-ounce wash bottles, C, C, one of which contains 4 fluid ounces of sulphuric acid, the other a like amount of solution of caustic potash. The second is connected, by means of a glass tube, with a glass percolator, D, covered with a sheet of rubber, through which the tube protrudes. The exit of the percolator is loosely inserted into the mouth of the bottle, E, which contains 4 fluid ounces of distilled water.

Fig. 12.



Connect the 16-ounce chemical flask, F, with an 8-ounce wash bottle, G, which contains 4 fluid ounces of distilled water, and is connected with the percolator, D, by means of the glass tube, H, protruding through the rubber cover. Into the flask, A, place a mixture of alcohol 2 fluid ounces, and sulphuric acid 12 fluid ounces; and into the flask, F, place 1 ounce of black oxide of manganese and 6 fluid ounces of hydrochloric acid, previously diluted with 4 fluid ounces of water. Apply heat now to the flask, A, by means of a spirit lamp, and, when the gas begins to flow, heat the flask, F, in like manner, and thus pass both gases (ethene and chlorine) simultaneously into the percolator, upon the sides of which an oily substance will form and trickle through the exit into, and settle to the bottom of, the distilled water. This is impure bichloride of ethylene, and must be agitated with water, then with sulphuric acid, and finally distilled. As the reaction progresses, the contents of the flask, A, may be slowly replenished, through the safety funnel, B, with a mixture of equal parts of sulphuric acid and alcohol. Finally, when the flow of gas ceases, or the reaction becomes irregular, suspend the operation, agitate the impure liquid collected in the bottle, E, with distilled water, then with sulphuric acid, and lastly distill it.

Bichloride of ethylene may also be prepared by the process of Limpricht (1856), who made it by passing olefiant gas through a retort half filled with a mixture of 2 parts of black oxide of manganese, 3 parts of common salt, 4 parts water, and 5 of sulphuric acid. The retort being gently heated at first with a single red-hot coal.

Description.—Bichloride of ethylene is a mobile liquid, colorless, inflammable, and possessed of a fragrant, ethereal odor, and a sweetish taste. It is very soluble in alcohol and ether, and only slightly so in water. Its specific gravity is 1.271 at 0° C. (32° F.), and its boiling point 85° C. (185° F.). Neither sulphuric acid nor hydrate of potassium affects it. Bichloride of ethyl must not be confounded with solution of ethyl chloride (C_2H_5Cl), or the so-called hydrochloric ether (see below).

Action and Medical Uses.—Bichloride of ethylene has been proposed as a much safer anæsthetic than chloroform, but it has not come into use on account of the excessive irritation of the throat and fauces attending its inhalation. It is occasionally used locally, in spray or otherwise, to allay the sufferings in certain maladies, from pain, as in *rheumatism, lumbago, neuralgia*, etc. The anæsthetic dose is about that of chloroform.

Related Compounds.—ETHYL CHLORIDE (C_2H_5Cl), *Hydrochloric ether*, is made by passing dry hydrochloric acid gas into cold alcohol, and purifying the product by distilling the contents of the retort, washing the gas with a little tepid water, and condensing in a receiver surrounded with ice and salt. Ethyl chloride, or chlorethane, is a volatile, highly inflammable liquid, boiling at 12.5° C. (54.5° F.), and is, consequently, gaseous at ordinary temperatures. Water dissolves 10 per cent, and alcohol, at 21° C. (69.8° F.), dissolves 48.3 per cent of its weight. Ethyl chloride, or hydrochloric (or muriatic) ether, is occasionally employed in combination with an equal volume of alcohol, as a substitute for the compound spirit of ether, in doses of from 5 to 20 drops diluted with water, wine, etc. It has been used locally to anæsthetize parts in *minor operations*. It must not be used near a flame, and its inhalation may depress the heart.

CHLORIC ETHER, is a name once applied to mixtures of alcohol, and from 5 to 18 per cent of chloroform. Afterward, it was prepared by distilling chlorinated lime with water and an excess of alcohol. It is seldom mentioned at the present day, and has properly become almost obsolete.

ETHYDENE CHLORIDE, *Ethylidene chloride, Ethydene dichloride*, or *Monochlorinated hydrochloric ether* ($C_2H_4Cl_2$, or $CH_3.CHCl_2$). Specific gravity 1.198. Boiling point 57.5° C. (135.5° F.). This compound, isomeric with bichloride of ethylene, is produced by acting upon ethyl chloride (see above) with chlorine, avoiding an excess of the latter. It has been tried as an anæsthetic, and though so far as physiological experiments go to show it is safer than chloroform, clinical evidence does not harmonize with that of the physiological investigators, and consequently its use as an anæsthetic has been practically abandoned on account of the number of deaths occasioned by it. According to Brunton, its action upon the cardiac ventricles is precisely like that of chloroform. It is now generally accepted as being more dangerous than the latter.

AGAVE VIRGINICA.—FALSE ALOE.

The root of *Agave Virginica*, Linné.

Nat. Ord.—Amaryllidaceæ.

COMMON NAMES: *False aloe, Rattlesnake's master.*

Botanical Source.—A perennial, herbaceous, stemless plant, with a premorse, tuberous root. Leaves linear-lanceolate, fleshy, glabrous, and radical, with cartilaginous, marginal serratures. The scape, which is round, and from 3 to 6 feet high, bears sessile, greenish-yellow flowers, scattered in a wand-like spike, emitting a strong fragrance. The root (the part employed) is very bitter, and yields its properties to alcohol and water by infusion.

History.—This plant is common to Pennsylvania and the Southern States, growing on dry or rocky banks, and flowering in August and September. In some parts of the country this plant is considered a valuable antidote to wounds by poisonous snakes, and is termed "rattlesnake's master."

Action and Medical Uses.—False aloe is reputed laxative and carminative, and has been beneficially employed in *obstinate diarrhœa, flatulency, spasm of the intestines*, etc.

Related Species.—*Agave Americana*, Linné. *American aloe. Nat. Ord.*—*Amaryllidaceæ.* Tropical America; naturalized in Florida. Cultivated for centuries in Mexico (A. DeCandolle). *American aloe, Maguey* or *Metl*, also called *Century plant*, from an erroneous supposition that it blossoms only once in a hundred years, is the largest of all herbaceous plants; it inhabits the warmer latitudes of the American continent, where it flourishes as an evergreen, and is utilized for hedges in southern Europe, where it is known as aloe. The agaves, from their resemblance to the aloe family, have been called aloes, as false aloe and American aloe; but the agaves differ from the aloe in having entirely different properties, both chemical and medicinal, and also in the relation of the botanical parts, the ovary of the latter being superior; that of the agave, inferior. All agaves are natives of Mexico. The aloe, on the contrary, is an Eastern plant. The leaves of the American aloe are long (4 to 6 feet), lanceolate, thick, succulent, and curved or reflected backward, and beset with marginal and terminal spines. The flowering scape may reach a height of from 20 to 40 feet, the plant blooming in its native habitat about once in a decade.

The *Agave Americana* and other species, particularly *A. pulqué*, are employed in Mexico in the manufacture of a spiritous beverage known as *pulqué*. This is prepared by fermentation of the saccharine liquid, known as *aguamiel* (honey water), which exudes from the leaves and root when cut. Occasionally this "honey water" is evaporated to a honey-like, or syrupy consistence, and may be resolved into sugar. *Distilled pulqué* is a brandy-like liquor called *mezcal*. The fibres of the leaves are made into thread and cordage, and are known as *pita*.

Gum maguey is analogous to gum arabic, though differing in the amount of calcium salts contained therein. It is partially soluble, the portion dissolving resembling arabin. The insoluble portion resembles bassorin. The pulp of the leaves, locally applied, acts as a rubefacient, somewhat like mustard. The fresh juice is said to act upon the kidneys and bowels, and also to promote menstruation. Dr. G. Perrin considers it a superior remedy in *scorbutus*, preferring it to lime juice, in doses as high as 2 fluid ounces 3 times a day (*N. Y. Jour. Med. N. S. VII.*, 181).

Agave mexicana, Lamarck; and *Agave vivipara*, Linné. These two species are closely related to the preceding plants, and are natives of Mexico.

AGRIMONIA.—AGRIMONY.

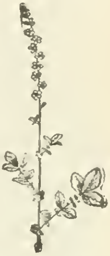
The whole plant of *Agrimonia Eupatoria*, Linné.

Nat. Ord.—Rosaceæ.

COMMON NAMES: *Agrimony*, *Cockleburr*, *Stickwort*.

Botanical Source and Description.—Agrimony is a perennial herb, growing to the height of 2 or 3 feet, having stems but little branched, and covered with a soft, silky pubescence. The leaves are alternate, long, nearly smooth beneath, interruptedly pinnate, having from 3 to 5 or 7 oblong-ovate, coarsely serrated leaflets, between which are interspersed several smaller ones. The root is long, fibrous, and tapering, and of a reddish-brown color. It is much branched at the summit, producing numerous heads. The flowers are small, yellow, and borne in a dense, racemose spike, from a half to 1 foot long. The calyx-tube is curiously fluted with 10 ribs, conical, and surmounted with reddish, hooked bristles. Agrimonia has a bitterish, harsh, subastringent taste, which is somewhat aromatic, but unpleasant. This taste is strongest in the root. Its odor is aromatic, and especially is it more fragrant when in bloom.

Fig. 13.



Agrimonia.

History and Chemical Composition.—Agrimonia is common in the United States and Canada, as well as in Europe and Asia. It thrives along roadsides, in old fields, and in woodlands, flowering from midsummer through September. The burrs attach themselves to the clothing as one comes in contact with them, hence the common names, cockle-burr and stickwort. It is employed in domestic practice on the continent as a gargle. The aborigines and Canadians used the root in the treatment of intermittent febrile states. According to Linnæus, a grateful beverage was prepared by steeping the plant in whey. Porcher states that an infusion of the leaves and stalks, previously treated with a weak bismuth solution, permanently dyes wool a beautiful, golden color, and that tanners employed the flowers in preparing soft and delicate hides. French peasants use it as a substitute for tea. Agrimony yields its properties to water and alcohol. Tannin and a volatile oil are the only known chemical constituents, the latter being obtained by distillation.

Action, Medical Uses, and Dosage.—Agrimony is a mild tonic, alterative, and astringent. A decoction of it is highly recommended in *bowel complaints*, *leucorrhœa*, *chronic mucous diseases*, *chronic affections of the digestive organs*, *profuse bleedings*, of an asthenic character, certain *cutaneous diseases*, *icterus*, etc. A strong decoction, sweetened with honey, is reputed curative in *scrofula*, if its use be persisted in for a length of time; and it has also been highly extolled in the treatment of *gravel*, *asthma*, *coughs*, and *obstructed menstruation*. Dr. D. C. Payne speaks highly of a continued use of a decoction of this plant in the treatment of *erysipelas* and *scrofulous affections*, to be used freely, in connection with diet and regularity of the bowels. It is also reputed to be valuable as a diuretic, and has been considered a specific in *dropsy* and in *gonorrhœa*. As a gargle, the decoction is useful in *ulcerations of the mouth and throat*. The astringency of the root renders it very useful in those affections requiring the exhibition of astringents.

Specifically, agrimonia checks mucous profluvia, and gives tone to mucous tissues. *Chronic bronchitis*, *phthisis*, with increased secretions, and muddy, ill-smelling urine, *humoral asthma*, and *chronic genito-urinary catarrhal states*, are most benefited by it. Pain in the lumbar region is relieved by it. *Cystitis*, *nephritis*, and an irritable condition of the bladder, are met by it, as is painful *renal congestion.* Dose: A drachm or two of the pulverized leaves may be taken for a dose, or 2 or 3 fluid ounces of the decoction; specific agrimonia, 1 to 60 drops.

Specific Indications and Uses.—Deep-seated and colicky pain in the lumbar region, with uneasy sensations reaching from the kidneys to the hips and umbilicus (renal colic); muddy, ill-smelling urine, and dirty looking skin; especially as a palliative in phthisis; cystic catarrh; cough, with profuse, thick secretions, and pain under the lower ribs, extending to the renal organs; renal congestion; cough, with dribbling or expulsion of urine; irritation of kidneys or urinary organs, with cough.

Related Species.—*Agrimonia parviflora*, Aiton. *Small-flowered*, or *Sweet-scented agrimony.* United States; Pennsylvania, southward and westward. Stronger scented than common agrimony; has smaller flowers, and from 11 to 19 pairs of densely crowded leaflets, with smaller ones interspersed. Has numerous resinous dots on the leaves, rendering it somewhat clammy.

Alchemilla vulgaris, Ladies' mantle. Europe. An astringent, bitterish herb, once much used in *diarrhœa.* Accredited by the ancient alchemists with wonderful powers.

AILANTHUS.—AILANTHUS.

The inner bark of the tree and root of *Ailanthus glandulosa*, Desfontaines.

Nat. Ord.—Simarubaceæ.

Common Names: *Tree of Heaven, Ailanto, Chinese sumach.*

Botanical Source.—Ailanthus is a large tree, with blunt, clumsy branches, which give to it an odd appearance after the leaves have fallen. The leaves are odd-pinnate, each consisting of from 10 to 20 pairs of leaflets and a terminal one. The leaflets are about 2 inches long, ovate, smooth, acute, and have a few blunt, glandular teeth at the base (hence, the specific name, glandulosa). The flowers are small, green, and collected in large terminal panicles. They are polygamous, or generally diœcious. The calyx consists of 5 united sepals. The petals are 5, small, green, and longer than the sepals. The stamens are 10 in the male flowers, but fewer in the female. The pistil is surrounded at the base by a disk, and consists of from 3 to 5, 1-ovuled, free carpels, with united styles. The fruit is a flat, membranous samara, bearing a seed in the middle, and somewhat resembling the fruit of the ash.

History, Description, and Chemical Composition.—*Ailanthus glandulosa* is a native of China, where it is known as "Ailanto," of which the German name "Götterbaum" is said to be a translation. "Tree of Heaven" is the name by which the tree is vulgarly known in this country. It is in common cultivation as a shade tree throughout Europe and the United States, and has become naturalized in many localities. It was formerly classified in the natural order, *Rutaceæ*, but is now placed in that of Simarubaceæ. It is allied to the genera, Quassia and Simaruba, from which it differs in the fruit being a samara.

This tree is of rapid growth, and easily accommodates itself to any soil, thus being well adapted to cultivation; but it is objectionable on account of a fetid odor, which is mostly exhaled from the sterile flowers. The genus Ailanthus consists of 4 species, all large trees, and natives of Asia, none of which, however, are cultivated in this country excepting the *A. glandulosa.* The recent root is white, hard and woody. It is covered with a white, fibrous bark, the outer part of which is gritty, brittle, and yellowish, over which is a gray epidermis. The epidermis of the limbs and growing sprouts is smooth, shiny and brown, or yellowish. It is studded with numerous little eruptions which increase in size with age, until, when old, the bark is rough. Beneath this a green coloring matter is found in young specimens, while the bark next to the wood is white. In growing shoots the woody matter is thin, surrounding a yellowish-brown pith, which latter decreases in proportion with the growth of the shrub. Both the root and shrub have an acid reaction when fresh, and exhale a disagreeable odor when broken. For medicinal purposes, the bark of the small bushes and roots is to be preferred. Prof. Hetet, of Toulon, noticed the tree in the *Journal de Pharmacie*, in 1859, at which time it attracted attention in France, in consequence of its leaves having been suggested as food for a species of silk-worm. The bark of the tree was experimented with, and attracted some attention at that time as an emeto-cathartic and anthelmintic, but it seems to have quickly fallen into disuse.

In the year 1875, Dr. H. L. True published an article in the *E. M. Journal*, which revived, among the Eclectic practitioners of this country, an interest in the therapeutical uses of the bark; since which numerous communications to medical journals have created a demand for it, the bark being supplied in abundance in most localities. In the later fifties, M. Payen analyzed the bark, and detected lignin, chlorophyll, yellow coloring matter, pectin, bitter substance, aromatic resin, traces of volatile oil, nitrogenous matter, and some salts. Afterward (1861), Mr. Alonzo Lilly, Jr., made an examination, the result of which differs considerably from the above, as, according to this gentleman, the constituents are, starch, tannin, albumen, gum, sugar, oleoresin, and a trace of volatile oil, potash, phosphoric acid, sulphuric acid, iron, lime, and magnesia.

The bark has a nauseating, bitter taste, and when recent, a sickening odor. Both the fresh and the carefully dried bark impart a deep-green color to alcohol, probably due to chlorophyll, the color gradually changing to yellowish-brown by age, the action of light accelerating the change. According to our experience, the bark contains a resinous substance, which, with the volatile oil, is extracted by alcohol, which agent will perfectly exhaust all the characteristic properties of either the fresh or dry ailanthus. According to the experiments of M. Hetet, the purgative property resides in the resin, while the volatile oil gives rise to the prostrating and other ill effects produced on those exposed to the vapors of the evaporating extract; and, probably, to a similar hydrocarbon, may be ascribed the sickening sensation experienced by many persons when inhaling the atmosphere vitiated by the emanations from an Ailanthus tree in blossom. M. Hetet's statement, that the resin is purgative, has been disputed; some even assert that the resin is inert.

Action, Medical Uses, and Dosage.—The bark of ailanthus has been employed by Roberts, Dugat, and others, both in the recent and dried state, as a remedy for *dysentery* and *diarrhœa;* also in *gonorrhœa, leucorrhœa, prolapsus ani*, etc. Fifty grammes of the root-bark are infused for a short time in 75 grammes of hot water, then strained, and when cold, administered in teaspoonful doses, night and morning. To lessen the disagreeable impression following its use, as well as to mask its bitterness, it may be administered in sweetened orange-flower water, or in some other aromatic. Professor Hetet, of the Toulon Naval School, states in *Jour. de Chim. Med.*, December, 1859, that the leaves and bark, in powder, or in the form of an aqueous or of an alcoholic extract, will remove *tapeworm*; but he found its action upon patients to be very disagreeable and nauseating, somewhat like that occasioned by tobacco upon young smokers. Dupuis has also found it useful as a tænifuge. In the September number of the *Eclectic Medical Journal*, for 1875, p. 393, Dr. H. L. True, of Ohio, states, that from his observations, the bark is not poisonous, but produces vomiting, great relaxation, and a death-like sickness, which symptoms gradually pass away. He has successfully employed a tincture of the root-bark in *cardiac palpitation, obstinate singultus, asthma*, and *epilepsy*. Its use in epilepsy has gained in reputation. It should be studied for its action in sick and nervous *headache*, with nausea, and an indescribable burning sensation in the forehead. Webster states, "the remedy, in 2x dilution, will cure *malignant sore throat, ulcerated tonsils*, and other *tonsillar inflammations*, marked by adynamia and persistency." He states that he has been pleased with it in *putrid, malignant, typhoid scarlatina*, with dusky, carmine eruption, high temperature, pungent surface, pulse small and extremely rapid, with thirst, delirium, and coma. The tongue is dusky, parched, and fissured; sordes upon the teeth; and the urine discharges involuntarily. Dose, 1 to 10 drops of the 2x dilution. His uses of the drug were derived from homœopathy. Dr. True considers the presence of these trees in malarial districts to have a strong action, similar to that of the eucalyptus, in antagonizing those influences that produce *intermittents*. The dose of the tincture is from 5 to 60 drops, repeated as often as required, or, from 2 to 4 times a day; specific ailanthus, 5 to 20 drops.

Specific Indications and Uses.—Cardiac palpitation; spasmodic or epileptiform muscular contraction.

Related Species.—*Ailanthus excelsa*, Roxburgh. Bark used in India as a powerful febrifuge, tonic and stomachic, being used in decoction in *dyspepsia*. Leaves and bark in good repute as a tonic after *labor*, and the juice of the leaves and fresh bark employed by the Concans as a remedy for *after-pains* (Dymock). Dajī found in it *ailanthic acid*, a reddish-brown, deliquescent mass, bitter, soluble in water, less so in ether and alcohol; insoluble in benzol and chloroform.

Ailanthus malabarica, De Candolle. Habitat, Canara. Yields a fragrant resin called "mutteepal," which is powdered and administered in small doses, in milk, for *dysentery* and *bronchitis*. It is also employed as incense. The bark is tonic, febrifuge, and valued in *dyspepsia* (Dymock).

ALCOHOL.—ALCOHOL.

FORMULA (Absolute, or ethyl alcohol): C_2H_5OH. MOLECULAR WEIGHT: 45.9.

SYNONYMS: *Ethyl alcohol, Ethylic alcohol, Ethyl hydroxide, Alcohol, Alcohol vini, Rectified spirit, Spiritus rectificatus, Vinic alcohol; Spirit of wine.*

Official Kinds.—I. ALCOHOL ABSOLUTUM (*U.S.P.*), *Absolute alcohol.* "Ethyl alcohol, containing not more than 1 per cent, by weight, of water"—(*U. S. P.*).

II. ALCOHOL (*U. S. P.*)—*Alcohol.* "A liquid composed of about 91 per cent, by weight, or 94 per cent, by volume, of ethyl alcohol ($C_2H_5OH = 45.9$), and about 9 per cent, by weight, of water"—(*U. S. P.*).

III. ALCOHOL DILUTUM (*U. S. P.*)—*Diluted alcohol.* "A liquid composed of about 41 per cent, by weight, or about 48.6 per cent, by volume, of absolute ethyl alcohol ($C_2H_5OH = 45.9$), and about 59 per cent, by weight, of water"—(*U. S. P.*).

IV. ALCOHOL DEODORATUM (*U. S. P.*)—*Deodorized alcohol.* "A liquid composed of about 92.5 per cent, by weight, or 95.1 per cent, by volume, of ethyl alcohol ($C_2H_5OH = 45.9$), and about 7.5 per cent, by weight, of water"—(*U. S. P.*).

The foregoing "should be kept in well-closed vessels, in a cool place, remote from lights or fire"—(*U. S. P.*).

History and Source.—The Bible frequently mentions fermented juices from various fruits, as the grape or pomegranate. However, the art of abstracting the alcohol from alcoholic beverages by distillation, was, in all probability, discovered by the Arabs in the ninth, or later centuries. The raw materials used in the making of alcohol by distillation, may be taken from three sources: 1. Alcoholic liquids which have already undergone fermentation, *e. g.*, wine, beer, cider. 2. Saccharine material which exists, for example, in sugar cane, or grape juice; from this, alcohol is generated by fermentation. 3. Starch-bearing material, of which an innumerable variety is available for this purpose, *e.g.*, root tubers, such as potatoes, and such cereals as rye, corn, barley, wheat, rice, etc. With this class of material, the conversion of starch into fermentable sugars (maltose, or dextrose), is effected in the so-called mashing process, whereby the starchy material, after preparatory treatment, is acted upon by an infusion of malt, the active principle of which, *diastase*, converts starches into maltose and dextrin, at temperatures not to exceed 70° C. (158° F.). In rare cases, perhaps, the starch is converted into dextrose (glucose) by treatment with dilute sulphuric acid, at a temperature near the boiling point of water.

Vinous, or Alcoholic Fermentation.—Fermentation, generally speaking, is a process of decomposition of more or less complex organic substances into simpler compounds, induced by the vegetative action of exceedingly small, living organisms, called ferments (to which belong, *e.g.*, the yeast plants and bacilli). The action of purely chemical ferments, called enzymes, as, *e.g.*, diastase in malt, or myrosin in black mustard seeds, etc., is analogous to, though not identical with, fermentation. Accordingly, we speak familiarly of acetic, lactic, butyric, putrid fermentation, etc. In the vinous fermentation, a solution of sugar, *e.g.*, dextrose, is decomposed into alcohol and carbonic acid gas, under the influence of the yeast plant, of which there are several species, the most prominent of which is *Saccharomyces* (*Torula*) *cerevisiæ*. Dextrose, for example, is decomposed as follows: $C_6H_{12}O_6 = 2C_2H_6O + 2CO_2$. This formula, however, illustrates the process only in a general way, as various circumstances tend to alter the above reaction. Pasteur has found among the products of vinous fermentation, about 0.6 per cent of succinic acid and 3 per cent of glycerin, as regular constituents. The most favorable temperature at which fermentation takes place, is from 15.5° to 32.2° C.

(60° to 90° F.); at temperatures somewhat higher than 30° C. (86° F.), butyric and other kinds of fermentation are liable to set in. Not all sugars are directly fermentable. Cane sugar, for example, under the influence of yeast, first becomes converted into fermentable invert sugar (an equi-molecular mixture of lævulose and dextrose).

The part played by the yeast cells has not yet been completely elucidated, notwithstanding the advances made in this direction through the famous researches of Pasteur, Liebig, Naegeli, and others. Some contend that fermentation is purely physiological, others, that it is a physical, and others again, that it is an essentially chemical process. Quite recently, E. Buchner demonstrated that a fluid obtained by expressing, under high temperature, moistened yeast, previously dried by strong pressure, is capable of producing fermentation.

Preparation.—The bulk of commercial alcohol is, at the present day, derived from cereals and potatoes; in Germany, principally from the latter source. If potatoes are the raw material used, they are first steamed in suitable, ingeniously devised vessels, in order to gelatinize the starch grains. After cooling the mass to a temperature of about 65.5° C. (150° F.), it is subjected to the process of mashing, in large vats with steam fittings, by mixing the mushy material with finely comminuted malt, whereby, under the influence of the malt diastase, starch is converted into maltose and dextrin, the latter being subsequently converted into maltose by prolonged action. Then the temperature is reduced to 21.1° C. (70° F.), and yeast is added, which starts the fermentation. Cereals are treated either in the same manner, or are merely crushed without being steamed, and are then subjected to the same treatment.

The fermented mass contains, of *non-volatile matters*, fibers and husks, inorganic salts, protein bodies, peptones, fat, yeast, lactic and succinic acids; of *volatile matters*, alcohol, fusel oils, and traces of fatty acids, *e.g.*, acetic acid, but not the higher acids, such as butyric, if the fermentative process was properly conducted. The alcohol may then be separated from the mash by fractional distillation in a simple copper still with worm condenser, the distillate being repeatedly distilled or *rectified*, in order to get a stronger product. This process is still in use in the making of Irish whiskies. In recent times this rather primitive procedure has been replaced by the introduction of ingeniously contrived stills, especially the so-called column-stills, the construction of which has reached such a state of perfection that it is possible to obtain, with some of these, a strong alcohol of 94 per cent, by direct distilling from the fermented mash in a single operation; the higher alcohols, as fusel oil, remaining behind for the most part. (For details see Sadtler, *Indust. Org. Chem.*, 1895.) The alcohol resulting from the first distillation, unless obtained at once pure and of the desired strength by the use of the perfected stills aforementioned, must be subjected to redistillation, called *rectification*. As it is extremely difficult, however, to completely remove by fractional distillation certain impurities, especially the higher alcohols, propyl, isobutyl, and the amyl alcohols, collectively called *fusel oils* or *grain oils*, it has been found advisable to purify the raw spirit prior to rectification. This has been tried more or less successfully by chemical means, employing oxidizing agents, as ozone, or silver nitrate; but a rather expedient and efficient method seems to be to dilute the spirit to a strength of about 50 per cent, whereby the fusel oil is thrown out as an insoluble layer; the spirit is then filtered through charcoal, and rectified (see Sadtler). Another efficient method is said to consist in distilling the spirit over fused acetate of sodium, employed in the quantity of 2 per cent. Another method, which seems promising, is to shake out the fusel oils from the dilute spirit with mineral oils (Bang and Rufin).

Commercial Forms.—*Absolute alcohol.* Mere rectification will not produce a liquid stronger than about 94 per cent, by volume. The remaining 6 per cent of water must be removed by chemical means; which is best accomplished by allowing the alcohol to stand over freshly prepared, unslacked lime, for several hours, then distilling from a water-bath, a process which should be repeatedly carried out. It is often preferred to boil the alcohol with unslacked lime for one hour, using a reflux condenser, and then distilling off the alcohol. This process, however, is attended with some danger if the alcohol has more than 5 per cent of water. Dehydrated chloride of calcium has also been used in preparing absolute alcohol.

Alcohol of the *U. S. P.* contains 91 per cent, by weight, or 94 per cent, by volume, of pure ethyl alcohol, and has a specific gravity of 0.820 at 15.6° C. (60° F.). This strength is obtained in the process of redistillation or rectification.

Ardent Spiritous Beverages.—*Holland gin*, is obtained by distilling grain spirit with juniper berries.

Rum, is made in the West Indies by fermentation and subsequent distillation of molasses derived from the sugar cane.

Arrack, is the distilled product of the fermented juice of the palm tree, in Batavia, or is obtained from rice and millet, in China, by malting, fermenting, and distilling.

Brandy, is the product of distillation of wines, or the fermented juices from such fruits as the apple or pear, called cider and perry.

Genuine cognac, is a fine grade of brandy, the product of distillation of French wines. Its characteristic aroma is due to the presence of œnanthic ether (oil of wine).

American whiskey, is prepared from malted corn and rye; either mixed grains are used (Kentucky bourbon), or malted rye alone (Pennsylvania whiskies).

Irish whiskies, have a smoky flavor, due to the peat fuel used in the making of the malt.

Description and Tests.—I. Alcohol Absolutum (*U. S. P.*), *Absolute alcohol, Anhydrous alcohol, Ethyl alcohol.* Pure absolute alcohol is "a transparent, colorless, mobile, and volatile liquid, of a characteristic, rather agreeable odor, and a burning taste. Very hygroscopic. Specific gravity not higher than 0.797 at 15° C. (59° F.); or 0.789 at 25° C. (77° F.). In other respects, absolute alcohol has the properties, and should respond to the reactions and tests, of deodorized alcohol (see *Alcohol Deodoratum*)"—(*U. S. P.*).

It boils at 78.3° C. (174° F.), and assumes an oleaginous consistence at —90° C. (—130° F.). It is very combustible, burning with a pale-blue flame, without smoke or residue, giving out a very intense heat, and producing carbonic acid gas and water. Chloride of sodium added to it will render its flame yellow; chloride of potassium, whitish violet; boric acid, or a salt of copper, green; chloride of lithium, carmine red; chloride of strontium, crimson; and chloride of barium, greenish-yellow. A solution of barium hydrate in absolute alcohol, detects traces of water in absolute alcohol by yielding a precipitate when mixed with it. Dehydrated copper sulphate, which is white, turns blue with absolute alcohol when water is present. It mixes in all proportions with water, wood-spirit, and ether; heat is evolved when it is added to water, and contraction of volume takes place, which amounts to nearly 4 per cent when 53.9 parts of alcohol, and 49.8 parts of water, are mixed, resulting in a volume of 100 parts, instead of 103.7 parts. One part of ether added to 2 parts of alcohol, forms with $\frac{1}{10}$ part of oil of wine, *Hoffman's Anodyne Liquor.* Partly on account of its affinity for water, it preserves animal and vegetable tissues. It dissolves hydroxide of potassium and of sodium, certain metallic chlorides and bromides, the organic acids, camphor, volatile oils, iodine, urea, resins, balsams, etc. With nearly all acids it produces the compound ethers. Most oxygen salts with inorganic acids, excepting calcium and magnesium nitrates, starch, caoutchouc, the protein compounds, etc., are insoluble in it. Of the fixed oils, castor oil is the most freely dissolved by it. It combines with many neutral metallic chlorides, as of magnesium, calcium, manganese, etc., taking, in these compounds, the place of water of crystallization. Sulphur and phosphorus are dissolved by it to a limited extent. Dry chromic acid introduced into a mixture of air and alcoholic vapor, causes an explosion. If a spiral piece of platinum wire be placed upon the wick of an alcohol lamp, and the flame be suddenly blown out, the platinum wire will continue to glow with a white heat, caused by the imperfect combustion of the alcoholic vapors.

II. Alcohol (*U. S. P.*)—*Alcohol.* The alcohol of commerce possesses the above qualities (see *Absolute Alcohol*) in proportion to its freedom from water, as known by its specific gravity. The strength of alcoholic fluids, the sole ingredients of which are alcohol and water, is determined in the spirit trade, under the supervision of the U. S. Government, by taking the specific gravity by means of hydrometers, also observing the temperature at which the specific gravity is taken. By the aid of tables, the actual percentage of the spirit, by volume, is then ascertained. *Proof spirit*, as defined by the U. S. Revenue Office, is a liquid containing 50 volumes of absolute ethyl alcohol in 100 volumes of spirits, this solution being called 100 *per cent proof spirit*. Its specific gravity is 0.9343 at 15.6° C. (60° F.). If higher, the spirit is below proof; if lower, the spirit is over proof. It is used in pharmacy to form tinctures, extracts, etc. The Pharmacopœia gives the following description and tests: "A transparent, colorless, mobile, and volatile liquid, of a characteristic, rather agreeable odor, and a burning taste. Specific gravity about 0.820 at 15° C. (59° F.); or 0.812 at 25° C. (77° F.). Miscible with water in all proportions, and without any trace of cloudiness; also miscible with ether or chloroform. It is readily volatilized, even at low temperatures, and boils at 78° C. (172.4° F.). It is inflammable and burns with a blue flame. It should not affect the color of blue or red litmus paper previously moistened with water. If 50 Cc. of alcohol be evaporated in a clean glass vessel, no color or weighable residue should remain. On allowing alcohol, mixed with one-third of its volume of water, to evaporate spontaneously from clean, odorless blotting-paper saturated with it, no odor of fusel oil, nor other foreign odor, should become perceptible. If 10 Cc. of alcohol be mixed in a test-tube with 5 Cc. of potassium hydrate T.S., the liquid should not at once become dark-colored (absence of aldehyde, methyl alcohol, or oak tannin). If 20 Cc. of alcohol be shaken in a clean, glass-stoppered vial with 1 Cc. of silver nitrate T.S., the mixture should not become more than faintly opalescent, or acquire more than a faint brownish tint, when standing during six hours in diffused daylight (limit of organic impurities, amylic alcohol, etc.)"—(*U. S. P.*).

III. ALCOHOL DILUTUM (*U. S. P.*)—*Diluted Alcohol.* "Alcohol, five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; distilled water, five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]. Mix them. If the two liquids be measured at the temperature of 15.6° C. (60° F.), the mixture, when cooled to the same temperature, will measure about 971 Cc. Diluted alcohol may also be prepared in the following manner: Alcohol, four hundred and ten grammes (410 Gm.) [14 ozs. av., 202 grs.]; distilled water, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]. Mix them. Diluted alcohol has a specific gravity of about 0.936 at 15° C. (59° F.), about 0.937 at 15.6° C. (60° F.), and about 0.930 at 25° C. (77° F.). It should respond to the reactions and tests given under *Alcohol*" —(*U. S. P.*).

IV. ALCOHOL DEODORATUM (*U. S. P.*)—*Deodorized alcohol.* "Specific gravity about 0.816 at 15° C. (59° F.), or 0.808 at 25° C. (77° F.). If 25 Cc. of deodorized alcohol be mixed with an equal volume of water and 5 Cc. of glycerin, and the mixture allowed to evaporate spontaneously from a piece of clean, odorless blotting-paper, no foreign odor should become perceptible when the last traces of the alcohol leave the paper (absence of fusel oil constituents). If 25 Cc. be allowed to evaporate spontaneously in a porcelain capsule carefully protected from dust, until only a moisture is left, no red or brown color should be produced upon the addition of a few drops of colorless, concentrated sulphuric acid (absence of amylic alcohol, non-volatile, carbonizable, organic impurities, etc.). In other respects, deodorized alcohol has the properties, and should respond to the reactions and tests, of *Alcohol*"—(*U. S. P.*).

"*Rules for making an alcohol of any required lower percentage, from an alcohol of any given higher percentage:*

I. BY VOLUME.—Designate the volume-percentage of the stronger alcohol by *V*, and that of the weaker alcohol by *v*.

Rule.—Mix *v* volumes of the stronger alcohol with pure water to make *V* volumes of product. Allow the mixture to stand until full contraction has taken place, and until it has cooled, then make up any deficiency in the *V* volumes by adding more water.

Example.—An alcohol, of 30 per cent by volume, is to be made from an alcohol of 94 per cent by volume.—Take 30 volumes of the 94 per cent alcohol, and add enough pure water to produce 94 volumes.

II. BY WEIGHT.—Designate the weight-percentage of the stronger alcohol by *W*, and that of the weaker by *w*.

Rule.—Mix w parts, by weight, of the stronger alcohol with pure water to make W parts, by weight, of product.

Example.—An alcohol of 50 per cent, by weight, is to be made from an alcohol of 91 per cent, by weight.—Take 50 parts, by weight, of the 91 per cent alcohol, and add enough pure water to produce 91 parts by weight"—(*U. S. P.*).

Uses in Pharmacy and the Arts.—In the numerous official pharmaceutical preparations, alcohol, of various strengths, is a prominent constituent. Pharmacists also employ it as a fuel producing a high temperature during combustion without depositing soot upon bodies introduced into its flame. It is largely used in the arts as a solvent and preservative.

Action and Toxicology.—Applied locally to the skin, alcohol first causes a cooling sensation, but if evaporation be prevented, heat and irritation follow, and inflammation may result if too long applied. The skin and the mucous membranes are hardened by it, and the latter corrugated, owing to its coagulating power over albumen, and the abstraction of water from the tissues. Some fat is also removed from the integuments. As it at first constringes the arterioles, it may act slightly as an anæsthetic. Taken into the stomach in small amounts, (usually of the various liquors) it augments the appetite and increases digestive power. Owing to dilatation of the arterioles, slight congestion of the mucous tissues takes place, and the buccal and gastric secretions are increased, but if continuously imbibed, this excessive secretion results in catarrhal conditions, and, continuing, may produce atrophy of the gastric glands and hyperplasia of the gastric connective tissue. Furthermore, pepsin is precipitated by it, allowing digestive impairment through the loss of that ferment. The inordinate outpouring of gastric mucus (gastric catarrh) causes fermentation of the fatty, starchy, and saccharine foods, resulting in sour stomach, heart-burn, pyrosis, and that peculiar retching and morning vomiting of the drunkard.

Alcohol is believed to enter the blood before reaching the duodenum, and in that fluid it diffuses itself with great rapidity. The portal circulation is impressed, and greater hepatic activity follows, but finally, this over stimulation leads to destruction of the liver cells, fatty and atrophic alterations taking place, while the connective tissue is increased. This hyperplasia, with consequent shrinkage of the cells, allowing contraction of the connective tissues, results in that shrunken, hardened, and nodular state of the organ, known as *cirrhosis*. These liver changes take place more rapidly than those of the stomach. Alcohol in small doses increases the heart's action and surface circulation; all the body functions are stimulated and better performed, and temperature is slightly elevated. Larger doses produce exhilaration and vascular excitement, and a mild intoxication. Still larger doses affect muscular power, causing incoördination of movement (staggering), and the victim speaks incoherently and in a rambling manner—all the well-known phenomena of *drunkenness*.

Upon the nervous system, the first effects are increased cerebral activity, rendering the senses more acute, and all the mental actions more energetic. These effects are shared in common with the increased functional activity of the economy in general. In an exposed brain, turgescent and throbbing vessels have been observed as the effects of its first action, with dilatation of the vessels, and passive congestion as the secondary phase (Jacobi). In toxic amounts, cerebration is suspended, and profound insensibility takes place; there is a feeble performance of the body functions, and the movement centers are poisonously impressed, resulting in complete muscular inactivity, stertorous respiration, and arrest of breathing and the heart's action.

In large quantities, and continued daily, alcoholic liquors occasion intoxication, nervous derangement, loss of appetite, mental imbecility, dyspepsia, indurated liver, granular disease of the kidneys, paralysis, mania, atheroma of the vessels, apoplexy, and death. The alcohol is absorbed, and may be detected in the blood, urine, breath, brain, liver, and other organs, producing permanent injury to them. The treatment of acute alcoholic poisoning consists in emptying the stomach by means of the stomach-pump, and cautiously applying ammonia gas to the nostrils; external warmth should be used, cold water applied to the head, and faradism employed to stimulate respiratory action. It is extremely difficult to differentiate acute alcoholic poisoning from apoplexy, opium poisoning, cerebral concussions, and hemorrhage into the brain tissues. The pupil may be contracted or dilated; unequal dilatation, however, is somewhat of a guide to intracranial hemorrhages. The odor of the breath will assist somewhat, but can not be relied upon, as alcoholic drinking is so common that any of these conditions may take place after one has imbibed an insufficient amount of alcohol to produce toxic symptoms. A person "dead drunk" should be treated as if poisoned, and not allowed to "sleep off" the effects.

After death from acute alcoholism, the gastric membranes are found intensely hyperemic, as are the meninges of the brain. The subarachnoidean spaces, and the cerebral ventricles, are filled with an effusion of serous fluid; and the right ventricle of the heart, and the great veins, are distended with blood. From chronic poisoning, hyperplasia of the connective tissue, as thickening of the stomach walls, cirrhotic liver, and fatty heart, and hardened and contracted, or fatty, kidneys as well as atheromatous vessels and sclerosed nervous structures, are found. Taken into the system in moderate amounts (1 to 1½ ounces of absolute alcohol) alcohol is scarcely eliminated, but is destroyed by oxidation in the system, and imparts circulatory, nervous, glandular, and muscular force. It refreshes the exhausted system by yielding to it a force to be applied in the body functions, and in this way acts as food, though it is not known to contribute to the building of a single cell or fibre of the animal structures. It also acts as food, in that it retards or checks tissue waste by partially preventing the excretion of carbon dioxide and nitrogenous material; and it even favors the formation of fatty tissues, as is shown by its pathological tendency to cause depositions of fat in certain organs. That the temperature is increased by moderate amounts is well known, as is the fact that large doses depress the temperature; and this depression is more pronounced if fever be present. It may be concluded that alcohol serves as food, when it is used short of gastric impairment, does not over-stimulate, and is not in excess of what can be burned in the oxidation processes of the organism. In quantities in excess of those above mentioned, it is excreted by the lungs, skin, kidneys, etc.

Contrary to popular notions, alcohol does not protect one from the influence of cold, as has been shown by the experience of Arctic explorers, and by the ease with which drunkards are frozen to death. Nor does it protect one from the effects of the heat. The facility with which topers are attacked with, and succumb to, epidemic disorders, proves conclusively the deleterious effects of its continued use, injuries do not heal so readily in the inebriate as in the temperate, and it is well known that chloroform is not well borne by them, nor can they as well withstand the shock of surgical operations. On the other hand, enormous amounts of alcohol may be ingested by those unaccustomed to it, when meeting with accidents, or suffering from the effects of hemorrhage, bites of insects and serpents, when suddenly depressed, and in convalescence from acute diseases. Infants and old people bear alcoholics well.

Medical Uses and Dosage.—Alcohol is seldom or never used internally, except in dilution. Undiluted, it is a powerful irritant and poison, rapidly causing intoxication, and, if in large quantities, death. It is usually employed in the form of wine, brandy, gin, beer, whiskey, etc., which, in moderate doses, act as diffusible stimulants, and are highly beneficial in prostrating diseases, and in cases where these kinds of stimuli are indicated. Brandy is said to be cordial and stomachic; rum, heating and sudorific; gin and whiskey, diuretic. There are very few cases in which alcoholic stimulants are necessary to be given, and those are seldom of a chronic character, or in which these fluids have to be used longer than a few days. The use of our small doses of concentrated alcoholic preparations, and improved modes of treating diseases, have done much to set aside the dangerous and unscientific practice of indiscriminately prescribing alcoholics. Exceptions to its non-use in chronic disorders, are cases of great debility with feeble digestion, such as the *gastric debility* of old age, and wasting of tissue, in *phthisis*. Here, as long as it favors digestion, acts kindly and prevents tissue waste, it is of marked value. If, however, it should occasion unpleasant symptoms, it will aggravate phthisis, a form of which is also known to result from alcoholic excesses. An ounce of brandy or whiskey may be given with milk, egg-nog, broth, or other liquid food; when cod-liver oil agrees with the stomach, alcoholics may be given with it. While in small doses it is a stomach tonic, it should not be employed in ordinary atony of the stomach, which other agents will overcome, on account of the danger of fixing upon the patient the alcoholic habit. Nor should those subject to neuralgic pains make general use of it; and for general, chronic adynamic states it is of less value than other agents.

Alcohol is mostly employed in acute disorders. Its utility in *delirium tremens* is well established. It will aggravate cases dependent upon the direct and sudden action of excess of alcoholics upon the gray brain-matter, but when it depends upon failure of the stomach to take and appropriate food, no remedy is more efficient; and opium and other stimulants assist its action. As long as the patient is able to take and retain and digest food, delirium will not occur. As soon, however, as gastric rebellion ensues, the stimulant must be given to allay the irritability and sustain the nervous powers. An ounce of whiskey, alone, or in milk, may be given every hour or two until the stomach will act without its aid. Give no more than enough to sustain the nervous system (Locke). In *high fevers* and *inflammations*, in those accustomed to the use of alcoholics, it is dangerous to wholly withdraw the stimulant, and it may be given at intervals in small doses. In acute diseases it is never admissible where there is determination of blood to the brain, or where there is severe, darting headache of a throbbing character, suffusion of the skin and eyes, and noisy or violent delirium. Nor should it be continued in any case where it increases the rapidity of the pulse, elevates temperature, or causes or increases dryness of the tongue. The condition in which it is admissible, is that of prostration, as in *low fevers*, the pulse being soft and feeble. Small quantities should be frequently repeated. Thus, in *typhoid*, and other *low fevers*, where there is a tendency to fainting, with low, muttering delirium, and dry tongue, the patient will die unless stimulation is resorted to, and nothing is better for this purpose than alcohol. Add 1 ounce of brandy to 3 of milk and give frequently, as necessary. If it slows the pulse, rendering it fuller, calms the delirium, tends to moisten the tongue and promote sleep, it is doing good as well as acting as food; if it increases the symptoms, it is doing harm, and should be discontinued.

In certain forms of *vomiting*, as of *sea-sickness* and *pregnancy*, alcoholics are of service. Give a glass of wine before rising from bed in the morning in the latter complaint. *Insomnia* and *somnambulism*, both when due to cerebral anemia, are benefited by alcohol. Refreshing sleep will follow its administration. Hyperemia of the brain contraindicates it. Threatened *inflammation* of the internal organs from exposure or cold, causing suppression of the functions of the skin, is often averted by a hot toddy and putting the patient to bed. In this manner, threatened *pleurisy* and *pneumonia* may be prevented. In the *exanthemata*, when exhaustion threatens, alcohol may be resorted to. In the collapse of *Asiatic cholera*, it is called for, and is of value in some cases of *traumatic tetanus*. Large doses sustain the nervous system while undergoing the effects of *serpent* and *insect bites and stings*. It should also be locally applied. Alcohol may be made to act as an external stimulant or refrigerant, by merely applying it to a part, and preventing its evaporation by placing a compress of linen or muslin over it, to produce the first effect; or, by allowing it to evaporate, to produce the latter. With an equal quantity of water, it forms a good dressing for *bruises*, *orchitis*, *arthritis*, and other *superficial inflammations*. *Cracked nipples*, should be bathed with brandy and dusted with bismuth subnitrate (Locke). Applied to threatened *bed-sores*, it hardens the tissues and prevents excoriations. Dr. Christison recommends "a mixture of equal parts of rectified spirit and white of egg as an application to *excoriations*, from pressure, in fever and other exhausting diseases. It is to be applied frequently with a fine brush or feather, and renewed as it dries, till an albuminous coating is formed over the part."

As a dressing to fresh *wounds*, alcohol, diluted, is of much value; and even in *suppurative injuries*, it corrects fetor and acts as an antiseptic, as well as to stimulate granulation. Owing to its coagulating power over albuminous material, alcohol is a hemostatic in conditions in which the blood slowly oozes, as from *abrasions*. *Aural polypi* and *unhealthy granulations of the tympanum*, the result of long suppurative processes, are well treated with absolute alcohol. This it does by coagulating albumen and abstracting water, and may cause permanent dryness of the tympanic membrane. Foltz regards it a specific in *tympanic cholesteatoma* (*Dynam. Ther.*). The dose of alcoholics (brandy, whiskey, etc.) should not be such as to exceed $1\frac{1}{2}$ fluid ounces of absolute alcohol, except in serpent poisoning, when more may be given.

Specific Indications and Uses.—Prostration, with soft, feeble pulse, hurried respiration, and irregular heart action; prostration, with dry tongue, low, muttering, or wandering delirium, tremor, subsultus, and insomnia; delirium tremens, when the gastric powers fail. Locally, to cholesteatoma of the tympanic cavity (absolute alcohol).

ALCOHOL AMYLICUM.—AMYLIC ALCOHOL.

FORMULA: $C_5H_{11}OH$. MOLECULAR WEIGHT: 88.

SYNONYMS: *Fusel oil, Oil of potato spirit, Corn spirit oil, Amyl alcohol, Pentyl alcohol, Grain oil, Amyl hydrate, Amyl hydroxide, Primary amyl alcohol.*

Preparation and History.—"Take of the light liquid, which may be obtained at any large distillery, by continuing the distillation for some time after the pure spirit has all been drawn off, any quantity. Introduce it into a small still or retort connected with a condenser, and apply heat so as to cause distillation; as soon as the oil begins to come over unmixed with water, the receiver should be changed, and the distillation being resumed and carried nearly to dryness, the desired product will be obtained. The liquid drawn over during the first part of the distillation, will consist of an aqueous fluid, surmounted by a stratum of the amylic alcohol. This latter, though impregnated with a minute quantity of water, should be separated and preserved, as being sufficiently pure for use"—(*Dub.*). It is usually prepared from fermented cereals, or potatoes, by distillation.

Amylic alcohol was first noticed by Scheele, in the spirit obtained by distilling fermented potatoes, and was called *Oil of potato spirit;* since his time its general character has been more fully investigated by several chemists. It is now found not only in potato spirit, but among the products of alcoholic fermentation generally, in which it exists in the $\frac{1}{400}$ or $\frac{1}{500}$ part. When alcohol is distilled from potatoes, toward the termination of the process a whitish fluid passes over, which, when allowed to rest, yields a deposit of amylic alcohol, combined with nearly equal parts of water and alcohol. This is washed several times in water, then placed in contact with chloride of calcium to remove the water, and distilled over again, in order to purify it. Alcohol and water pass over at first, but as the heat becomes elevated to 132.2° C. (270° F.), a clean receiver is substituted for the one just used, into which the pure amylic alcohol is received as it passes over. It is viewed as a hydrated oxide of amyl.

Description.—Amyl alcohol is a limpid, transparent, very mobile, oily liquid, colorless, or of a light-yellow color, having a very nauseous odor, producing stupefaction, and an acrid, sickening taste. Its vapor, when inhaled, causes cough and spasmodic dyspnœa, resembling asthma, often followed by vomiting. It produces an evanescent stain on paper; gives a bluish-white flame when burned with a wick, or heated to 55° C. (131° F.); boils at about 132° C. (269.5° F.); has the specific gravity 0.818; and absorbs hydrochloric acid gas largely, heat accompanying the process. It unites in any quantity with alcohol, ether, fixed and volatile oils, and concentrated acetic acid; is hardly dissolved by water, to which it imparts its odor, and the property of becoming beaded when shaken. Iodine, camphor, phosphorus, resins, fatty matters, sulphur, etc., are dissolved by it; and it combines with solutions of potash or soda without alteration. Heated with dry potash, it undergoes decomposition, evolving hydrogen, and forming valerianate of potassium by absorption of oxygen. According to Pasteur, ordinary amylic alcohol consists of a mixture of two metameric bodies, one being inactive on polarized light, the other producing left-handed rotation of a polarized ray; these two alcohols can be separated. Fusel oil may be detected in alcohol by introducing the suspected fluid into a burette, diluting it with its volume of rectified ether, and an equal volume of distilled water;

slightly agitate and allow it to rest. The ether will float upon the surface of the liquid, holding all the fusel oil in solution. Separate the ether by the usual method, allow it to evaporate spontaneously, and the fusel oil remains behind, known by its bad odor. Amyl alcohol of commerce contains from 20 to 30 per cent of common alcohol. By exposure to the atmosphere in the presence of platinum-black, slow oxidation takes place, with the formation of valerianic acid as the result.

Hirsch (*Amer. Jour. Pharm.*, 1862) has proposed to remove alcohol from fusel oil by the following process: Shake fusel oil with an equal volume of saturated salt solution, repeat the operation, finally shaking out with pure water. Then distill the washed fusel oil with 3 to 4 times its weight of distilled water in a retort; the distillate will then consist of an oily layer of almost pure amyl alcohol, and an aqueous layer containing what little alcohol has remained unabstracted in the preceding treatment.

Action and Medical Uses.—Valerianic acid, and several medicinal valerianates, are prepared by the aid of amylic alcohol. It is also used in preparing amyl nitrite, artificial fruit essences, and in the production of certain proximate principles, alkaloids, etc., notably the cinchona alkaloids. Fusel oil is said to produce the peculiar nervous and dyspeptic symptoms of those accustomed to consuming large amounts of alcoholics; the rapid intoxication produced sometimes, is likewise attributed to this body, occurring as an adulterant. Even in small doses, amylic alcohol induces a tensive pain in the head, while in excessive amounts, insensibility and profound narcosis result. The breath exhales a fruit-like odor. Among the poisonous symptoms are giddiness, staggering, headache, diplopia, unconsciousness, reduction in temperature, rigidity and subsequent relaxation of the muscles, marked cyanosis, and death. In cases of poisoning by it, ether and other stimulants may be subcutaneously injected. Amylic alcohol, in very small doses, is a nerve stimulant. It has been used in *phthisis*, with negative results. The *nervous irritability* and weakness of habitual drunkards, is said to be relieved by small doses of fusel oil.

ALCOHOL METHYLICUM.—METHYL ALCOHOL.

FORMULA: CH_3OH. MOLECULAR WEIGHT: 31.93.

SYNONYMS: *Wood alcohol*, *Wood naphtha*, *Pyroxylic spirit* (or *alcohol*), *Pyroligneous spirit* (or *alcohol*), *Spiritus pyroxylicus rectificatus*.

Preparation and History.—This substance was first carefully studied and named by Dumas and Peligot (1834), though previously differentiated from ethyl alcohol by Philip Taylor, in 1812, and noticed still earlier by Boyle, in 1661. As a result of the destructive distillation of wood, several substances are obtained (as noticed under *Acetic Acid*), among them 1 per cent of *crude pyroxylic spirit*. When calcium carbonate is added to the aqueous liquor containing the crude product, the salt calcium acetate is formed, and upon distilling the solution, that portion passing over before a temperature of 100° C. (212° F.) is reached, contains the crude wood alcohol. The next step is its purification, which is accomplished by saturating it with fused chloride of lime, forming thereby, with the crude spirit, a crystalline body, which is then distilled to allow impurities to pass over. To separate the pyroxylic spirit from the calcium compound, water is added, and the mixture again distilled, after which it is freed from the water by being left in contact with dry lime, and rectified.

Description and Tests.—Anhydrous methyl alcohol, when pure, is a limpid liquid, colorless, has a pungent, burning taste, and a peculiar odor, somewhat like that of acetic ether and alcohol. Like alcohol, it burns with a pale-blue, though less luminous, flame. Alcohol, ether, and water dissolve it in all proportions, and its solvent properties are said to be the same as those of alcohol. It may be distinguished from acetone by its power of dissolving calcium chloride. It should be free from a smoky odor. Its boiling point is about 67° C. (152.6° F.), and it has a specific gravity of 0.8021 at 15.5° C. (60° F.). Its vapor occasions conjunctival irritation. *Crude pyroxylic spirit* is used largely in the arts and especially as a solvent for resins in the manufacture of varnishes. The *methylated spirit* of Great Britain is a mixture of alcohol, $\frac{8}{9}$ parts, and pyroxylic spirit, $\frac{1}{9}$ part. It is employed in laboratories in making ether, nitrous ether, and chloroform, and is used in the arts as well, for its solvent properties and on account of being cheaper than ethyl alcohol, the duty on which is heavy, unless to be used in the arts; then the duty is removed by the Government. But in this case the ethyl alcohol must be mixed with wood-spirit, so as to render it unfit for use in beverages.

At present, an important use of wood alcohol is for the production of formaldehyde (see *Formaldehydum*). Wood alcohol should not become colored by exposure to the air and light. It mixes with water in all proportions, without becoming muddy, and when pure has no action on paper stained with vegetable colors. It may be preserved without alteration in a vessel, though imperfectly corked; but when its vapor, mixed with air, is left in contact with spongy platinum, much heat is evolved, and formic acid is formed. It dissolves many salts, many resins, hydroxides of potassium and sodium, most essential oils, and forms crystalline compounds with chloride of calcium, barium oxide, and lime. The admixture of ethyl alcohol is recognized by the fact that concentrated sulphuric acid will, upon warming, liberate ethylene gas. In the absence of ethyl alcohol, the presence of acetone may be shown by its capacity of yielding iodoform upon warming with iodine and sodium carbonate.

Action, Medical Uses, and Dosage.—The fumes of wood spirit occasion conjunctival irritation, nausea, anorexia, headache, and vertigo. It was the preparation recommended by Dr. J. Hastings as a remedy for *phthisis pulmonalis;* he incorrectly termed it *Wood naphtha*. Although it has no influence in effecting cures in this disease, it is frequently of service in relieving the *cough* and feverish symptoms which manifest themselves. As to its action in vomiting, Christison says, "I can amply confirm all that has been said of it as an antiemetic remedy in cases of *chronic vomiting;* for in cases of this affection, depending on both functional or organic disease, I have frequently seen the vomiting arrested, or greatly mitigated, by pyroxylic spirit." It has also been found of service in *dysentery* and *diarrhœa*, *dyspepsia*, *catarrhal disorders*, and for the expulsion of *intestinal worms*. The dose is from 5 to 20 drops, 3 or 4 times a day, mixed with a fluid drachm or two of compound tincture of cardamom and a fluid ounce of water. It may be substituted for alcohol in lamps for chemical purposes, and answers exceedingly well for making varnishes, as it is more volatile than alcohol. Bodies which contain much oxygen, are more readily dissolved by it than hydrogenous bodies. It has now been practically abandoned as a medicine.

ALETRIS.—ALETRIS.

The rhizome of *Aletris farinosa*, Linné, gathered after the plant has flowered.

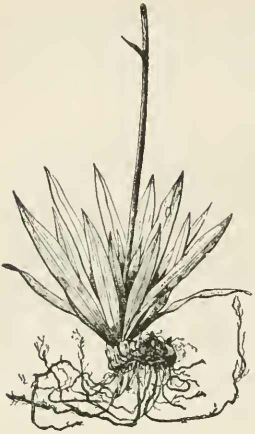
Nat. Ord.—Hæmodoraceæ.

ILLUSTRATION.—*Strong's American Flora* (exclusive of root), p. 65.

COMMON NAMES: *Blazing star*, *Star grass*, *Starwort*, *False unicorn root*.

Botanical Source.—Aletris is a small herb found in most parts of the United States. The common name is *Star grass*, but the term *False unicorn* is sometimes used. The name *Unicorn root* is more properly applied to *Chamælirium* (*Helonias*). Aletris is also known as *Blazing star*. The leaves are all radical and grass-like, from $\frac{1}{4}$ to $\frac{1}{2}$ inch wide, and from 2 to 4 inches long. They are smooth, entire, acute, and of a firm texture, and have from 6 to 10 parallel and quite prominent veins. The flowering stem is erect, from 2 to 3 feet high, and arises from the center of the cluster of root leaves. It has no stem leaves, but at intervals of about 2 inches, there are very small, linear scales, which may readily escape detection without a close examination. The stems are round and striate near the base, but angular above. The flowers are perfect, and in slender, terminal, simple racemes. They are on short pedicles, with small bracts at the base. The perianth is cylindrical, urn-shaped, white, with a yellowish tinge at the apex; wrinkled, rough and mealy outside, and 6-cleft at the summit. The stamens are 6, small and included. The ovary is ovate, and tapers to a slender style, which is trifid at the apex. The fruit is a dry, many-seeded, acute pod, opening by 3 valves.

Fig. 14.



Aletris farinosa.

History and Description.—The commercial drug, under this name, as found upon the market, is generally the rhizome of Chamælirium (see *Chamælirium*). Strange as it may seem under these circumstances, the two roots have no resemblance, are utterly unlike, and their appearance forbids admixture. We can not recall a single instance where Aletris farinosa was *adulterated* with Chamælirium, and yet so universal has the substitution of the last become, that Prof. King. in describing the root of Aletris (*Amer. Disp.*, 8th ed., p. 78), has given a description of that of Chamælirium, and *Strong's American Flora* figures the top of Aletris with the rhizome of Chamælirium. In this connection, we invite attention to our exact engraving of the Aletris plant and root (Fig. 14), and, as a comparison, invite attention to the engraving of Chamælirium (see *Chamælirium*, Fig. 66).

When dry, the root of Aletris farinosa is from ½ to 1 inch in length, seldom longer. It is surrounded and completely hidden by an intricate mass of fibers, remains of radical leaves and partly decayed matter. The recent growth of yearly fibres are white, and from 2 to 6, or even 10, inches in length. In texture, they are made up of a hard, durable, brown, woody center, over which are several layers of white, tissue-like epidermis, that peel off by age, and decay. Thus we find the lower portion of the dry rhizome of Aletris farinosa covered by a mass consisting of dead, brown, woody fibers of former years, from which the paper-like envelope has separated, together with white, recent rootlets from which the white epidermis is still scaling; while intermixed, are the chaff-like remains of the epidermis, in various stages of decomposition.

The radical leaves spring directly from the upper part of the growing end of the creeping rhizome. They contain numerous hard, round, woody fibers running lengthwise with the leaf, and from year to year, as the succulent portions of the leaves decay, the fibers remain and hold the fragments of mealy leaf-matter; and thus the upper, as well as the lower portion of the primary root is perfectly concealed from view. The dried root proper is about ¼ of an inch in diameter just beneath the leaves, and tapers from this point to nearly ⅛ of an inch; very often the extreme end turns downward, and usually terminates abruptly. The surface is rough, scaly, and thickly covered with root fibers below, and leaf scars and leaf fibers above. Internally, it is soft, spongy, white or slightly straw-colored, the central portion being less firm than the outer. It is odorless, acrid to the taste, *not bitter*. Chamælirium (Helonias), on the contrary, is very bitter.

Physicians should insure the identity of Aletris when purchasing. There is no excuse for confusion, as the two plants (Aletris and Chamælirium) are entirely different in appearance, the roots do not resemble each other, and are, to the taste, utterly unlike; and while Chamælirium has a peculiar and characteristic odor, the Aletris is odorless.

Action, Medical Uses and Dosage.—Owing to the confusion which formerly resulted from the substitution of the root of aletris for helonias, erroneous statements have been made regarding the status of the drug in female complaints. The drug must be restudied to determine its true place in therapy. Enough is known, however, to place it among the simple bitter tonics and stomachics, and as such it is employed to promote the appetite and aid digestion, and in *flatulence*, *colic*, *borborygmi*, etc. This root and its preparations are almost entirely employed in *dyspeptic conditions;* while, in the abnormal conditions of the female reproductive organs, the chamælirium is used. The dose of specific aletris is from 5 to 20 drops.

ALISMA.—WATER PLANTAIN.

The leaves of *Alisma plantago*, Linne.

Nat. Ord.—Alismaceæ

Common Names: *Water plantain*, *Mad-dog weed*.

Botanical Source, Description, and History.—A perennial, caulescent herb, growing in watery places, along streams, in marshes, and on the borders of ponds. Water plantain has long (4 to 6 inches), radical, oblong, or lanceolate leaves, subcordate at the base, cuspidate, or abruptly acuminate, and borne on long petioles. The flowers, which appear in July and August, are small, white, and numerous, and borne in a loose, whorled panicle on a scape, 1 or 2 feet high. The root is fibrous, and serves a Russian tribe as food. The American species is said to be a variety, and is known as *Alisma plantago*, var. *Americanum*, Gray. In odor, the root when fresh is said to resemble orris root, and has a sickening, acrid taste. A pungent, volatile oil, and a resin, are its only constituents. Water plantain inhabits the North American continent, as well as Europe. The root was formerly considered efficacious in hydrophobia, but repeated trials have shown it to be impotent. The leaves are the parts used.

Action, Medical Uses, and Dosage.—An infusion of the dried leaves is an excellent remedy in *urinary diseases;* the leaves, dried and powdered, have been successfully employed in *gravel*, and other urinary affections. The indications are: "Irritation and uneasiness in passing water, frequent desire to micturate, pain in the loins, and involuntary muscular movement" (Scudder, *Spec. Med.*). Dose of the infusion, from 4 to 6 fluid ounces, 3 or 4 times a day; of the leaves, 1 to 2 drachms. The fresh leaves, bruised and applied to the skin, irritate and redden it, and, not infrequently, will cause vesication.

Specific Indications.—(See above).

ALKANNA.—DYER'S BUGLOSS.

The root of *Alkanna tinctoria*, Tausch; (*Anchusa tinctoria*, Linné; *Lithospermum tinctoria*).

Nat. Ord.—Boraginaceæ.

Common Names: *Alkanet*, *Dyer's bugloss*.

Illustration: Artus' *Hand Atlas*, Vol. II., p. 438.

Botanical Source.—This plant is a weak, hairy herb, about a foot high, with alternate, oblong, entire, bicuspid leaves. The flowers are small, and disposed in terminal racemes, usually in pairs, which unroll as the flowers expand. The calyx is 5-lobed, and the corollas funnel-shaped, with a red tube about the length of the calyx-lobes, and a blue, 5-parted limb. The fruit consists of 4 distinct nutlets, which are contracted, and not hollowed, at the base.

History and Chemical Composition.—The Alkanet plant is indigenous to, and cultivated in the southern part of Europe. The roots of the cultivated plants are not so rich in the red coloring matter as are those grown in their native soil. The genus Alkanna is closely related to Anchusa and Lithospermum, and the roots of all three genera yield red coloring matters. Alkanet root contains the red coloring matter—*anchusin* or *alkanet-red*. To obtain it (Wittstein) the root is exhausted with water to remove gum and foreign coloring matters, then dried, ground, and percolated with alcohol. The alcoholic tincture is acidulated with hydrochloric acid, distilled, and evaporated to the consistence of a soft extract; this is exhausted with ether, water added, and, after agitation, the lower liquid separated. The ethereal solution is again washed with water, decanted, and evaporated. *Anchusin*, is dark, red-brown, brittle, neutral, and volatile, subliming in violet-red vapors. It is insoluble in water, soluble in chloroform and alcohol, more soluble in ether and oils. Sulphuric acid dissolves it with an amethyst color; solution of alkalies, with blue. The other constituents of the plant are unimportant.

Description.—Alkanet root, as obtained in this market, is often worm-eaten, and of very inferior quality. It appears as fragments, mixed with entire roots from 6 to 12 inches in length. They are dark purple externally, lighter within, pliable and spongy. The root is largely employed by manufacturers of pomades, hair oils, ointments, etc., for the purpose of coloring them. For these purposes, a solution of the *alkanet-red* is made by covering the crushed root with castor-oil, macerating, and straining; the deep red coloring matter is thus obtained, in solution, and this solution is added to the oil or pomade until the desired shade is produced.

Uses.—This root is rarely, if ever, employed therapeutically, though stated to possess emollient properties. Its chief use among pharmacists is for coloring certain articles. It is asserted that it is used to color adulterated wines.

Other Coloring Agents.—ARNOTTA, *Annotta*, *Annatto*, *Orellana*, *Orleana*. These various names refer to the coloring principle of the pulp of the seeds of *Bixa Orellana*, Linné (*Nat.Ord.*, Bixaceæ), a medium-sized tree of the American tropical regions. The whitish, obovate and angular seeds are inclosed in deep-red pulp. According to Peckholt (*A. J. P.*, 1859), the coloring matter is obtained by soaking the bruised seeds in water (or allowing them to ferment in water), rubbing the pulp from the seeds by hand, passing the liquid mass through a sieve, and finally mashing the seeds and washing again with more water. The coloring matter is allowed to settle, then dried, and formed into cakes or cylindrical pieces. A coloring matter also remains in the water employed. Prime annotta is plastic, generally quite soft, having the red color of blood, becoming, when exposed to air, of a deep reddish-brown. When dry or old, it is brittle and hard. It has an unpleasant, saline, bitterish taste, and a peculiar sweetish odor. It is scarcely soluble in water, in which it softens, however, and to which it imparts a yellow color. Alcohol, fixed oils, ether, and alkalies dissolve it, an orange-red or deep-red solution being formed. Heat does not fuse it, and it is inflammable. There are two grades known in commerce—the *French* (*flag annotta*), the best for coloring purposes, though it possesses the most disagreeable odor, probably having been prepared by the fermentation process; and the *Spanish* (*Brazilian*), which is not unpleasant to the sense of smell. Annotta contains two coloring principles; one, discovered by Preisser, a non-crystalline, bright-red, resinous body, called *bixin* ($C_{15}H_{18}O_4$, Stein; $C_{28}H_{34}O_5$, Etti); *orellin*, the second coloring body, is yellow, and soluble in water. Nitric acid colors bixin yellow, producing an odorous body resembling musk in odor; sulphuric acid colors bixin blue. Besides other compounds, annotta contains a terebinthinous body and a fatty acid. The seeds contain phosphoric acid, silica, and potassa (Ebert). Annotta is subject to adulteration, the agents employed being sand, chalk, gypsum, brickdust, red ochre, turmeric, and starchy bodies. The mineral impurities will refuse to dissolve in boiling alcohol. Annatto is employed to dye fabrics, especially silk, an orange-yellow fugitive color being imparted. In pharmacy, ointments and plasters are sometimes colored with it, while in the arts it is used to produce "butter color," for giving yellowness to butter and cheese. This preparation may be obtained by digesting annotta, 1 part, until wholly disintegrated, in alcohol, heating with olive oil (or some other bland oil) 4 or 5 parts, by weight. Another method is to add to olive oil (1 part), extract of arnotta (10 parts). A small quantity of turmeric is added when the preparation is desired as a cheese-color.

BRAZIL WOOD. Several South American and West Indian species of Cæsalpinia yield this red dye-wood. There are two chief commercial kinds, (1) *Pernambuco* (*Fernambuco*) *wood*, the most valued, and the Brazil wood proper, from *Cæsalpinia Braziliensis* and *C. crista;* and (2) *Brasiletto*, from the West Indian and Jamaican *C. vesicaria*, of less value. Analogous to *Brasiletto* are the *sappan*, or *samfen wood* (from *C. Sappan*), and the *Nicaraugua*, or *peach wood* (*C. echinata*). Brazil wood was formerly used in medicine, but now has only a limited use in pharmacy, viz., to color tinctures. It is largely used in dyeing, and to some extent in preparing lakes and red ink. Its coloring matter is extracted by water. The wood has a faintly-sweetish taste, and practically no odor. *Brazilin*, or *brasilin* ($C_{16}H_{14}O_5$), the coloring principle, is sulphur-yellow (colorless if absolutely pure) and crystallizable, sparingly dissolved by water, the solution being clear, nearly colorless, and sweet. Acids do not affect the solution, but alkalies redden it. Ether and alcohol produce pale yellow solutions. Brazilin quickly becomes red in the sunlight, and more slowly in diffused light, hence it must be kept in the dark. The red color produced by exposure to light and air is due to the production of *brazilein* ($C_{16}H_{12}O_5$).

Onosma echoides, Lamarck. South Europe. A hairy, rough perennial, whose flowers at first white, finally become yellow. The root, which is conical, and has a deep-red bark which is black on the outer surface, is used as a substitute for alkanna in coloring.

Lawsonia alba, Lamarck. (*Nat. Ord.*, Lythraceæ). *Henna*, or *Alhenna*, is produced from this plant, which is much esteemed by the inhabitants of India and other Oriental lands. Mohammed is said to have spoken of it as the "best of herbs." Innumerable conditions are said to be curable with it, among them *headache*, *smallpox*, *leprosy*, and "*burning feet*," a peculiar and obscure affection met with occasionally in India, etc. Dioscorides speaks of it as a plant "whose leaves dye the hair of an orange color." In Africa and Asia, and among the Mahometans especially, the custom is in vogue of dyeing the feet and hands orange-yellow, a practice said to have prevailed among the ancient Jews and Egyptians. The coloring matter, which appears like a brown-resinoid material, is a sort of tannin to which the name *hennotannic acid* was given by Abd-el-Aziz Herraory.

Maclura aurantiaca, *Osage orange*. Bark of root yields a yellow dye. Alexander King isolated from it *moric* and *moritannic acids*.

ALLIUM (U. S. P.)—GARLIC.

The bulb of the *Allium sativum*, Linné.
Nat. Ord.—Liliaceæ.
COMMON NAME: *Garlic.*

Botanical Source.—The garlic plant has a stem about 2 feet high, leafy below the middle. It terminates in an umbelliferous head of pink, red or whitish flowers, intermixed with bulbs, enveloped in a calyptriform, horned spathe. They appear in July, and are rather longer than their stamens. The leaves are acute, distichous, glaucous, and channelled above. The medicinal part is the very proliferous, clustered bulbs, many of which are invested in the same silvery skin.

Description.—The bulb is compound, subspherical, covered with membranous scales. About 8 wedge-like, compressed bulblets, are arranged circularly around a central stem-base. The smaller bulbs are appressed laterally, and consist of succulent scales, enveloping a central, fleshy mass. Garlic has an acrid, warm taste, and a disagreeable, pungent, alliaceous odor.

History, Action, and Chemical Constituents.—Garlic is a native of Sicily, and is indigenous in Asia Minor and Central Asia, but is cultivated in gardens in various sections of the United States and Europe. The bulbs of this plant are official; when removed from the ground some of the stem is left attached, so that after desiccation, by exposure to the sun, or in a warm room, several stems may be secured together, thus forming small bundles for sale. The root loses about one-half its weight by drying, but scarcely any of its smell or taste. Garlic should be used without being previously dried. Though changing color, garlic may be preserved in a closed jar with a small amount of alcohol for some length of time, without impairment of its virtues. All parts of this plant, but more especially the bulbs, have a strong, offensive, very penetrating and diffusible smell, and an acrimonious, almost caustic taste; both of these properties are owing to an acrid, volatile oil, of a deep, brownish-yellow color (when crude), heavier than water, and possessing, in a strong degree, the odor and taste of the plant; sulphur is one of its constituents, the oil containing 6 per cent of a compound ($C_6H_{12}S_2$) and 60 per cent of a substance ($C_6H_{10}S_2$); the rest are higher sulphur compounds. Allyl sulphide does not occur in the oil (Semmler, 1892). When purified it is without color, not so heavy as water, and consists chiefly of a sulphur compound. Water dissolves a small amount of it, while in ether and alcohol it is readily soluble. In contact with the skin, it occasions violent pain, rubefaction, and frequently vesication. Garlic yields its properties to alcohol, vinegar, acetic acid, and boiling water by infusion.

Action, Medical Uses, and Dosage.—Garlic is stimulant, diuretic, expectorant, and rubefacient; it is used both for medical and culinary purposes. The medicinal effects above stated are owing to the absorption of its volatile oil, the stimulating action of which causes thirst, promotes the activity of the various excretory organs, as the skin, kidneys, and mucous membrane of the air-tubes, communicating its odor to their excretions. It has been beneficially used in *coughs*, *catarrhal affections*, *pertussis*, *hoarseness*, *worms*, and *calculous diseases*, during the absence of inflammation. Externally, it has been employed as a resolvent in *indolent tumors*, and as a counter-irritant in *cerebral* and *pulmonary affections*. When applied along the spinal column and over the chest of infants, in the form of poultice, it is very useful in *pneumonia*; and placed over the region of the bladder, it has sometimes proved effectual in producing a discharge of urine when retention has arisen from torpor of the bladder. Garlic juice, oil of sweet almonds, and glycerin, of each equal parts, mixed, and dropped in the ear, has cured several cases of *deafness*, due probably to excessive cerumen, or to chronic debility of the mucous tissues of the organ of hearing. The dose of fresh garlic is 1 or 2 drachms; of the juice, a small teaspoonful. Large doses cause nausea, vomiting, purging and other unpleasant symptoms. The juice is often made into a syrup with sugar, by nurses, for *coughs*, *catarrh*, and *pulmonary affections of infants.* The odor imparted to the breath by garlic and onions, may be very much diminished by chewing roasted coffee grains, or parsley leaves and seeds.

Related Product.—Allyl Tribromide. A product closely related to oil of garlic may be produced by the interaction of bromine and allyl iodide. It has the composition $C_3H_5Br_3$ (or $CH_2Br.CHBr.CH_2Br.$), and the name *allyl tribromide* or *tribromhydrin*. A product identical with rectified oil of garlic is produced by acting upon allyl iodide with sulphide of potassium in alcoholic solution. Allyl tribromide is a colorless, or pale-yellowish fluid, congealing with the appearance of a stearopten at 10° to 15° C. (50° to 59° F.). Allyl tribromide has been administered in 5-drop doses (in capsules) in *infantile convulsions, angina pectoris, hysteria, asthma, whooping-cough*, and similar *spasmodic complaints*.

ALLIUM CEPA.—ONION.

The bulb of the *Allium Cepa*, Linné.

Nat. Ord.—Liliaceæ.

Common Name: *Onion.*

Botanical Source.—The common onion is a biennial garden plant, having a scape, which appears the second year, 2 to 4 feet high, being naked, smooth, straight, stout, swollen at the base, and fistulous, bearing at the top a round umbel of greenish-white flowers. The leaves are round and fistulous, of a shining green color, acute, and shorter than the stem. The part employed is the bulb.

Description.—The onion is a tunicated bulb, compressed or round, or oblong in figure, invested with a shining, thin, dry membrane, of a reddish or white color. It is less pungent to the taste than garlic, with some degree of sweetness, and a peculiar, well-known odor. Onion bulbs are of various shapes and sizes, usually globular, the layers being juicy.

History and Chemical Composition.—This biennial plant is supposed to be a native of Hungary, but is now found in all parts of the world. According to Fourcroy and Vauquelin, onion contains an acrid, volatile oil, uncrystallizable sugar, gum, albumen, woody fiber, acetic and phosphoric acids, phosphate and citrate of calcium, and water. The oil is colorless, acrid, and contains sulphur. It was investigated, in 1892, by Semmler, who found it to be mainly composed of a sulphur compound, $C_6H_{12}S_2$. A peculiar wine may be made by fermenting the juice of the onion.

Action and Medical Uses.—Onion possesses properties allied to those of garlic, but in a milder degree, and the absorption of its oil and influence upon the system is somewhat similar to that of the oil of garlic. Onions do not agree with all persons, especially dyspeptics, in whom they favor the production of flatus, which, however, is a common symptom among all those who eat largely of them; boiling, in a great measure, deprives them of this property. Sugar and onion-juice form a syrup, much used in domestic practice, for *cough* and other affections of the air-tubes among children. A roasted onion employed as a cataplasm to *suppurating tumors*, or to the ear in *otitis*, has proved beneficial. A saturated tincture of onions made with good Holland gin, has been found serviceable in *gravel* and *dropsical affections*. A cataplasm of onions pounded with vinegar, applied for a number of days, and changed 3 times a day, has been found to cure *corns* and *bunions*.

Related Species.—*Allium Porrum*, Linné. The *Common leek*. *Allium Schœnoprasum*, Linné. The *Chives*. *Allium Ascalonicum*, Linné. The *Shallot*. The above species possess similar medicinal qualities, though less active. They have the characteristic odor, though milder, and are cultivated in gardens for the same purpose as the onion.

ALNUS.—TAG ALDER.

The recent bark of the *Alnus serrulata*, Aiton. (*Alnus rubra*).

Nat. Ord.—Betulaceæ.

Common Names: *Tag alder, Red alder, Black alder, Smooth alder, Common alder.*

Botanical Source and History.—This shrub grows plentifully throughout the United States from Southern New England to the western border of the Great Lakes and southward. It occurs as clumps or thickets, along the borders of streams, rivers, ponds, and in swamps, attaining a height of from 6 to 15 feet. The stems are straight and the leaves smooth, somewhat coriaceous, obtuse, doubly serrate, round or blunt at the apex, and are accompanied by elliptical, obtuse stipules. Its flowers appear in March and April, before the leaves have expanded, and are of a reddish-green color. The pistillate flowers are borne in an erect, and the staminate, in a drooping, catkin. The fruit, which is ovate, often persists throughout the winter and gives rise to the name "tag alder." The bark is brownish-gray when fresh, and has an astringent, bitterish taste.

Chemical Composition.—The bark contains tannin, oils, and resin. The first may be precipitated with gelatin. A lesser quantity is found in the leaves. Alnus is chemically antagonized by the mineral acids, alkalies, ferric salts, salts of lead and silver, and gelatin.

Action, Medical Uses, and Dosage.—To the taste tag alder is bitter and astringent. It powerfully increases retrograde metamorphosis and exerts a direct tonic action upon mucous surfaces, aiding digestion and assimilation. It is a true catalytic and a positive anti-putrefactive agent. Locally applied, the decoction stains the skin. The drug stimulates the gastric mucous membrane and causes an increased flow of gastric juice. Applied to the mammæ, the leaves are said to decrease the lacteal secretion. It is alterative, emetic, and astringent.

This much neglected, but very important, remedy is a valuable agent in *scrofulosis*, especially in those cases marked by glandular enlargements and suppuration. Prof. Scudder speaks of it as one of the most valuable of our indigenous remedies, and points to its use in "superficial *diseases of the skin* and *mucous membranes*, taking the form of *eczema* or *pustular eruption*." Administered internally and applied locally in these conditions, we may expect from alnus the best of results. *Impetigo*, *prurigo*, *herpes*, and *scorbutus*, are diseases in which alnus will be of great utility. In *scurfy tetter* of the *scalp*, in children, it is of much value. The happiest results are obtained from its use in successive crops of *boils*. It is a good agent in *passive hemorrhages*, particularly in *hematuria*, for which a decoction of the cones has also been used, and it is favorably mentioned for *purpura hemorrhagica*. In *marasmus* of children, it is a much praised remedy. Combined with rumex crispus, and used locally and internally, it is a good drug in *nursing sore mouth* of mothers. Alnus is an important drug in *indigestion* and *dyspepsia*, when resulting from deficient secretion of gastric juice and debility of the muscular coat of the stomach. It may be associated with specific nux vomica. In *diarrhœa*, caused by or attended with deficiency of the gastric secretion, it serves an excellent purpose. It has been used with good results as an injection for *leucorrhœa*, and the leaves may "scatter" *indurations of the mammary glands* during the nursing period. Dr. A. D. Ayer reports many cases of *periodical hyperæsthetic rhinitis* (*hay fever*) cured by alnus. He recommends a distillate prepared after the manner of distillate of hamamelis. The distillate is first used with an equal bulk of water and snuffed up the nostrils 5 or 6 times daily. It may be increased to full strength in a day or two. If desirous, it may be applied by atomization. At night the nose is smeared with the distillate combined with petrolatum. At the same time give internally: ℞ Distillate of alnus, gtt. xv to xxx, in a little water, 1 hour before or after meals. Dr. Ayer also recommends this preparation in the acute stage of *gonorrhœa*, and as an antidote to *rhus poisoning*. The remedy is most effectual in infusion (fresh alnus bark, ℥j, aqua Oj); dose, a wine-glassful. Specific alnus, 1 to 20 drops.

Specific Indications and Uses.—The specific use of this remedy is to improve nutrition and increase waste. It is of particular value in *scrofula*, with feeble vitality, and *chronic skin diseases* exhibiting scaly or pustular eruptions.

Related Species.—*Alnus glutinosa*, Gærtner. (*Betula Alnus*, Linné). Europe. A tree about 30 feet high, the bark of which contains tannin, and is employed for the same purposes as the *Alnus serrulata*. Its bark is probably gathered indiscriminately with that of the latter. The wood resists water, and has been much used for posts and piles, for wet situations, the wood thus becoming very hard and durable. It was formerly employed in making water-pipes, pump-trees and reservoir conduits; in sculpture, turnery and cabinet-making; for making wooden household utensils, wooden shoes and soles, etc. Europeans have used the bark for tanning and dyeing, and a charcoal from its timber in preparing gunpowder (Hogg, *Nat. Hist. of Veg. King*).

Alnus viridis, De Candolle. *Mountain alder*. North America. This species is a shrub 3 or 4 feet high, the bark of which is employed in *dropsical complaints* by a British-American tribe of Indians living in the vicinity of Hudson's Bay.

ALOE.—ALOES.

The inspissated juice obtained from the leaves of several species of Aloe.

Nat. Ord.—Liliaceæ.

Official Kinds.—I. Aloe Barbadensis (*U. S. P.*), *Barbadoes aloes* (*Curaçao aloes*), *Hepatic aloes*. Derived from the *Aloe vera* (Linné), Webb; (*Aloe vulgaris*, Lamarck; *Aloe perfoliata*, var. *vera*, Linné; *Aloe Barbadensis*, Miller).

II. Aloe Socotrina (*U. S. P.*), *Socotrine aloes*, *Zanzibar aloes*. Derived from *Aloe Perryi*, Baker.

Non-Official Kinds.—Aloe Capensis (*U. S. P.*, 1870), *Cape aloes*, *Aloe lucida*. Derived chiefly from *Aloe spicata*, Thunberg, *Aloe ferox*, Lamarck, and *Aloe Lingua*, Linné (*Gasteria Lingua*, Willdenow). Various other species probably contribute to this variety. A kind known as *Jefferabad aloes* enters the Bombay markets, and is thought to be derived from *Aloe abyssinica*, Lamarck.

Botanical Source and History.—*Aloe vera* (Linné), Webb, grows in the East Indies and Barbary; is now cultivated in the West Indies, as well as in some of the southern sections of Europe. The stem is woody, simple, cylindrical, and short; the leaves fleshy, amplexicaul, first spreading, then ascending, lanceolate, glaucous-green, flat above, convex below, armed with hard, distant, reddish spines perpendicular to the margin, and a little mottled with darker color; the parenchyma is slightly colored brown, and very distinct from the tough, leathery cuticle. The scape is axillary, glaucous, reddish, and branched; the spike is cylindrical-ovate. The flowers are at first erect, then spreading, afterward pendulous, yellow, and not longer than the stamens (L). This plant yields the Barbadoes aloes of commerce.

Several species, formerly regarded as distinct, are now regarded as varieties of this species; among them are *Aloe littoralis*, König; *Aloe indica*, Royle, and others.

Aloe Perryi, Baker, the now recognized source of Socotrine aloes, resembles in habit the *Aloe vera* (Linné), Webb, but its leaves are shorter and the tube of the flowers is of a much greater length than the segments. The flowers are also borne on long pedicles and arranged in racemes much looser than those of the Barbadoes plant. The true aloes plant, and that from which the drug was formerly believed to have come, is the *Aloe socotrina*, which inhabits the Island of Socotra. The stem is woody, straight, 1½ feet high, or more, and naked below, where it is strongly marked with the scars of leaves. Leaves amplexicaul, ascending, ensiform, green, curved inward at the point, convex below, rather concave above, marked with numerous small white marginal serratures; parenchyma abounding in a bright brownish-yellow juice. The raceme is cylindrical and unbranched; flowers scarlet at the base, pale in the middle, green at the point. Stamens unequal, three of them longer than the flowers.

Aloe spicata, Thunberg, or *Spiked aloe*, inhabits the southern parts of Africa, where it grows in sandy soil. The stem is woody, round, and about 4 feet high, and from 3 to 5 inches in diameter; the leaves are thick, fleshy, subverticillate, broad at the base, gradually narrowing to the point, full 2 feet long, channeled, distantly toothed, and dotted with a few white spots; their parenchyma is almost colorless. The spike is a foot long, and very compact; the flowers are scarlet, horizontal, campanulate, and filled with a purplish honey. The three petals are broader, ovate, obtuse, and white, with a triple green line; the sepals are narrower, and less concave. The stamens are much longer than the perianth (L). This plant (together with others above mentioned) furnishes the Cape aloes of commerce.

There are several species which furnish medicinal aloes, but the three above named are supposed to yield the principal portion, although but two are now recognized by the *U. S. Pharmacopœia*. The mucilaginous juice expressed from the parenchymatous tissue of the leaves has no remedial influences; but only that which is procured by incising the air-ducts of the leaves transversely, so that the juice may flow from them or, as stated by M. E. Robiquet, from the intercellular structure between them. M. Marais states that three distinct kinds of Barbadoes aloes have been found in commerce, two of which are probably obtained by simple exudations of the juice from the incised leaves, while the third is the result obtained by boiling the plant in water and evaporating. These three kinds may be distinguished from the other species of aloes by a common property they have of giving a perfect emulsion when triturated with a little cold water.

Cultivation and Preparation.—Of the method of obtaining Socotrine aloes little is known. In regard to Barbadoes aloes, the authors of the *Pharmacographia* state: "In Barbadoes, where *Aloe vulgaris* [*A. vera* (Linné), Webb] is systematically cultivated for the production of the drug, the plants are set 6 inches apart, in rows which are 1 to 1½ feet asunder, the ground having been carefully prepared and manured. They are kept free from grass and weeds, but yams or pulse are frequently grown between them. The plants are always dwarf, never in the least degree arborescent. Almost all of those above a year old bear flowers, which, being bright yellow, have a beautiful effect. The leaves are 1 to 2 feet long; they are cut annually, but this does not destroy the plant, which, under good cultivation, lasts for several years. The cutting takes place in March and April, and is performed in the heat of the day. The leaves are cut off close to the plant, and placed *very quickly*, the cut end downwards, in a V-shaped, wooden trough, about 4 feet long and 12 to 18 inches deep. This is set on a sharp incline so that the juice, which trickles from the leaves very rapidly, flows down its sides, and finally escapes by a hole at its lower end into a vessel placed beneath. No pressure of any sort is applied to the leaves. It takes about a quarter of an hour to cut leaves enough to fill a trough. The troughs are so distributed as to be easily accessible to the cutters. Their number is generally 5; and by the time the fifth is filled, the cutters return to the first and throw out the leaves, which they regard as exhausted. The leaves are neither infused nor boiled, nor is any use afterwards made of them except for manure. When the vessels receiving the juice become filled, the latter is removed to a cask or reserved for evaporation. This may be done at once, or it may be delayed for weeks or even months, the juice, it is said, not fermenting or spoiling. The evaporation is generally conducted in a copper vessel; at the bottom of this is a large ladle, into which the impurities sink, and are from time to time removed as the boiling goes on. As soon as the inspissation has reached the proper point, which is determined solely by the experienced eye of the workman, the thickened juice is poured into large gourds or into boxes, and allowed to harden"—(*Pharmacographia*).

In Cape Colony, according to Peter MacOwan, a goat-skin is spread in a shallow depression scratched in the earth, and the aloe leaves are radially arranged in such a manner that the juice falls into the center of the skin. When filled, the juice is poured into an iron pot and boiled, great carelessness being manifested by the operator throughout the whole process (see *Pharmacographia*).

Description and Tests.—ALOE BARBADENSIS (*U. S. P.*), *Barbadoes aloes.* This variety comes "in hard masses, orange-brown, opaque, translucent on the edges; fracture waxy or resinous, somewhat conchoidal; odor saffron-like; taste strongly bitter. Mixed with alcohol and examined under the microscope, it exhibits numerous crystals. Mixed with nitric acid, it acquires a red color. *Barbadoes aloes* is not colored, or acquires only a light bluish-green tint on being mixed with sulphuric acid and blowing the vapor of nitric acid over the mixture (difference from *Natal aloes*)"—(*U. S. P.*). *Barbadoes aloes* is not so bright and clear as the Socotrine variety, is of darker color, more compact texture, drier, though not so brittle, with a stronger and more disagreeable taste, being intensely bitter and nauseous, with little or nothing of the aromatic flavor of the Socotrine; it is extremely apt to induce hemorrhoids, and is principally used among veterinary physicians.

ALOE SOCOTRINA (*U. S. P.*), *Socotrine aloes.* "In hard masses, occasionally soft in the interior, opaque, yellowish-brown, orange-brown or dark ruby-red, *not* greenish, translucent on the edges; fracture resinous, somewhat conchoidal. When breathed upon, it emits a fragrant, saffron-like odor. Taste peculiar, strongly bitter. Almost entirely soluble in alcohol and in 4 parts of boiling water. The aqueous solution becomes turbid on cooling and yields a deposit. Mixed with alcohol and examined under the microscope, *Socotrine aloes* exhibits numerous crystals. The powder, on being throughly dried on a water-bath and then heated to 100° C. (212° F.), should not cake. Mixed with nitric acid, it acquires a reddish-brown color. *Socotrine aloes* is not colored blue on being mixed with sulphuric acid and blowing the vapor of nitric acid over the mixture (difference from

Natal aloes)"—(*U. S. P.*). It is hard and friable in the winter, somewhat plastic in summer, and growing soft between the fingers; easily pulverizable; and, when reduced to powder, of a bright, golden color. Aloes of superior value, whether from the Island of Socotra or not, are often commercially designated as *Socotrine aloes*—(*Ed.*, Duncan).

ALOE CAPENSIS, *Cape aloes* (*Shining aloes*). *Cape aloes* has a glossy or resinous fracture, a deep-brown or olive color, with a greenish tint. a shining, smooth surface; and thin scales of it are nearly transparent, having a ruby color. Its odor is more powerful and unpleasant than the *Barbadoes aloes;* its taste peculiar and bitter; and its powder is bright yellow, somewhat like gamboge, but having a greenish tint. The finer East Indian varieties are sometimes confounded with the Socotrine.

OTHER ALOES.—*Hepatic aloes* is the name applied to a variety of Socotrine aloes at one time commercial in Europe. In this country Barbadoes aloes has been called by this name. Any of the opaque and liver-colored aloes have also been known under this term. *Jefferabad aloes* (already referred to) is inferior in taste and odor to the Socotrine and has a lustrous, pitch-black color. *Natal aloes*, from Natal, is of a pale brown-yellow or a brown-gray color, quite different from the other varieties. It is carefully prepared, but the plant yielding it is still undetermined. *Moka aloes*, is a disagreeably odorous, nearly black, opaque variety, prepared in Arabia. *Caballine aloes* (*Horse aloes*) was the term by which impure and fetid grades of various sources were formerly known in European commerce.

Aloe Purificata (*U. S. P.*), PURIFIED ALOES.—The following is the Pharmacopœial method for purifying aloes and a description of the product: Take "Socotrine aloes, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏]. Heat the aloes by means of a water-bath until it is completely melted. Then add the alcohol, and having stirred the mixture thoroughly, strain it through a No. 60 sieve, which has just been dipped into boiling water. Evaporate the strained mixture by means of a water-bath, constantly stirring, until a thread of the mass becomes brittle on cooling. Lastly, break the product when cold into pieces of a convenient size, and keep it in well-stoppered bottles. The product is in irregular, brittle pieces of a dull-brown or reddish-brown color, and having the peculiar, aromatic odor of *Socotrine aloes*. It is almost entirely soluble in alcohol"—(*U. S. P.*). Aloe should never be boiled for any length of time, as its medicinal virtues are thereby diminished. It is dissolved by alcohol, whether diluted or not. A clear solution made with cold water reddens litmus, gives a deep, olive-brown color with ferric chloride, is deepened in color by alkalies, is unchanged with gelatin, and forms a copious yellow precipitate with acetate of lead. Heat occasions fusing, frothing, charring, and ignition, burning with a crackling noise, and a dense smoke which has the peculiar aloetic smell.

Chemical Composition.—The disagreeable odor and taste of aloes is due to a pale yellow, mobile, volatile oil, but minute traces of it existing in the plant. Aloes contains a resin, *Resin of aloes*, being that portion which separates upon cooling the hot aqueous solution of the drug. The chief body of interest, however, is that announced by T. & H. Smith, of Edinburg, and called *aloin*. As it was first found in Barbadoes aloes, it is now known as *barbaloin*, since a similar but distinctly different substance was later found in Socotrine aloes, called *socaloin*, and in the Natal variety, *nataloin*, all three being closely connected chemically, but having each distinctive differences. The *aloëtin* (*aloësin*, *resino-amara* [of Braconnot], or *aloe bitter*), the *bitter extractive* of aloes of Robiquet and other early investigators, was probably aloin in an impure, or at least modified, condition. The official *aloin* is composed of *barbaloin* or *socaloin* (see *Aloinum*).

Barbaloin ($C_{17}H_{20}O_7$, Sommaruga and Egger, 1874), forms small yellow crystals, soluble in water, alcohol and ether (see *Aloinum*). Brilliant yellow needles of *bromaloin* may be produced with it by treating its cold, aqueous solution with bromine water, and recrystallizing from alcohol; chloraloin may likewise be produced from it. A rapidly-fading crimson color is struck when treated to a drop of nitric acid. Heated with the same acid, it yields aloetic, chrysammic, picric and oxalic acids (Tilden).

Socaloin ($C_{15}H_{16}O_7$, Sommaruga and Egger), was observed by Pareira (1852) in the liquid Socotrine aloes, brought into England and isolated, in 1856, by T. B. Groves, who regarded it as identical with the preceding. Histed (1871) proved it to be distinct. It forms in small, tufted, yellow needle-crystals, soluble in absolute alcohol, water, ether, acetic ether, and methyl alcohol (see *Aloinum*). Heated with nitric acid an orange-red coloration ensues, and acids corresponding with those obtained from barbaloin are obtained. This form is also known as *zanaloin*. Tilden, in 1886, obtained from both kinds of aloin yellow crystals of alorxanthin (methyl-tetraoxyanthraquinone) by oxidation with potassium chromate and sulphuric acid.

Nataloin ($C_{16}H_{18}O_7$, Sommaruga and Egger) was first isolated by Prof. Flueckiger, in 1871, from Natal aloes. It forms thin, light-yellow scales, soluble, according to Flueckiger, at 15.5° C. (60° F.), in methylic alcohol (1 in 35), acetic ether (1 in 50), ether (1 in 1236), and in absolute alcohol (1 in 230). Water, hot or cold, very sparingly dissolves it. It is soluble in alcohol (60 parts). Picric and oxalic acids, but not chrysammic acid, are formed from it by treatment with nitric acid. This variety does not yield a bromine compound.

If the formulæ above given for the three varieties of aloin by E. von Sommaruga and Egger, of Vienna (1874), be correct, these bodies would seem to constitute an homologous series.

The following beautiful tests for the three aloins were pointed out by Histed: "A drop of nitric acid on a porcelain slab gives, with a few particles of barbaloin or nataloin, a vivid crimson, but produces little effect with socaloin. To distinguish barbaloin from nataloin, test each by adding a minute quantity to a drop or two of oil of vitriol, then allowing the *vapour* from a rod touched with nitric acid to pass over the surface. Barbaloin (and socaloin) will undergo no change, but nataloin will assume a fine blue"—(*Pharmacographia*).

The afore-mentioned *aloetic acid* has the composition $C_7H_2(NO_2)_2O$, and is orange-red, while *chrysammic acid* ($C_{14}H_4[NO_2]_4[OH]_2O$), occurs in laminæ of a vivid golden-yellow color. It has an explosive property when heated. Needles of an indigo color of the sublimable body *hydrochrysamide*, are produced from the last-named acid by means of deoxidizers. The resin of aloes was found by Tilden and Rammell, in 1872, to be separable into two resins—one soluble by prolonged boiling; the other insoluble. While both are nearly similar to barbaloin in composition, the first lacks the elements of water, being regarded as the anhydrid of barbaloin. The insoluble resin is very similar in structure.

Czumpelik (1861), by prolonged boiling of Socotrine aloes with an alkali, and Hlasiwetz (1865) with sulphuric acid, obtained *para-cumaric acid* ($C_6H_4[OH].CH:CH.COOH$). This, when fused with potassium hydroxide, yields *para-oxybenzoic acid*. *Alorcinic acid* was also obtained with these bodies by Weselsky (1872). By distillation of aloes with quick-lime, Robiquet (1846) obtained a yellowish oil, *aloïsol*, an odorous body since shown by Rembold to be a mixture of xylenol (dimethylated phenol), acetone, and hydrocarbons. Aloes, distilled with zinc-dust, yielded Graebe and Liebermann (1868) *anthracene* ($C_{14}H_{10}$), and Liebelt, in E. Schmidt's laboratory, *methylanthracene*.

Action, Medical Uses, and Dosage.—Tonic, purgative, emmenagogue, and anthelmintic. In doses of from ½ grain to 1 grain, 2 or 3 times a day, aloes exerts a decided tonic influence, but is seldom resorted to for this purpose. As a laxative and purgative, its applications are unbounded; it acts more especially on the muscular coat of the large intestines, rather increasing their peristaltic motion than effecting copious, thin or watery discharges; and from its tendency to produce heat and irritation about the anus, it is extremely improper (except in minute doses in debilitated individuals) for persons disposed to or troubled with piles. When applied endermically to an ulcer or blistered surface, it purges as effectually and promptly as when taken into the stomach; 10 grains used thus will purge in from 6 to 10 hours. Administered to nursing mothers it will purge the sucking child. It is commonly supposed to have no action on the jejunum or ileum; and some imagine it to influence the duodenum, especially the mouths of the biliary ducts, causing an increased flow of bile and stimulating the intestinal canal, when that secretion is suspended, as in jaundice. It acts upon the uterus, promoting the menstrual flow, which is partly owing to the stimulation of the organ, and the determination of blood toward it, occasioned by the medicine. It is said that 1 to 3 grains of extract of hyoscyamus, or hops, or 2 grains of ipecacuanha, mixed with the aloetic dose, will prevent its irritating effect on the lower intestines. An increase of the quantity of aloes beyond the medium dose is not attended by a corresponding increase of effect. Aloes has been efficacious in *constipation*, *dyspepsia*, and *ascarides;* in this last instance being used in form of an injection, 10 grains to 3 ounces of water, for children. In *chlorosis* and *amenorrhœa*, it has often proved serviceable, and is used for this purpose in various combinations. In cases of delicate females, with loss of appetite, torpor of the bowels, and suffering, with *suppression of the menses*, the following has been recommended for the purpose of exciting proper ovarian or uterine action: Take of the best aloes, pulverized, asafœtida, pulverized, each, ½ drachm; cantharides, pulverized, 20 grains; mix and rub well together with a little soap, and divide into 20 pills. Of these give from 1 to 3, 3 times a day. If the patient be very feeble, some of the salts of iron may also be added. Injections of aloes, composed of from 10 to 30 grains dissolved in 2 or 3 fluid ounces of water, and thrown up the rectum daily, and continued for a week previous to the menstrual period, have sometimes proved effectual. For *habitual constipation*, aloes should never be given in cathartic doses. Debility and marked intestinal torpor point to its selection. ℞ Aloes, gr. j; powdered ipecac, gr. ss; extract nux vom., gr. ¼. Mix. Make 1 pill. Sig.: Give 1 such pill from 1 to 3 times a day, according to the condition. If the liver is active, less of aloes will be required than if it be torpid. A pill of aloin, belladonna, ipecac and strychnine, is much used in *chronic constipation*. There are some cases of *piles*, with marked relaxation of the rectal tissues, that are benefited by minute doses of aloes or aloin, and both are effectual remedies in *rectal prolapse*, due to debility. In both cases there is an associated condition of feeble innervation, in which case the minute dose tends to increase the nutrition of the nervous system.

Aloes should never be given in inflammatory affections, in irritable, plethoric habits, in gastritis, enteritis, and, as a rule, where piles are present; nor to females liable to sudden uterine evacuations, nor during pregnancy. In hemorrhoids it may be given when modified by combination, or in the minute doses above referred to. Soap, or an alkaline carbonate, lessens its irritant action. The union of other purgatives with aloes often modifies its tendency to irritate the rectum. One grain of aloes with 2 or 3 grains of sulphate of iron will also modify this action, and will produce as much effect as 2 or 3 grains of aloes. As a laxative, aloes will be found useful in *habitual constipation*, from intestinal torpor, *jaundice*, *scrofula*, *hypochondriasis;* and as a cathartic, where there is a tendency to *cerebral congestion*. Dose of aloes is from ¼ to 10, or even 20, grains; and the most convenient form of administration is that of pill. It enters as a constituent into a great number of useful compound remedies.

Specific Indications and Uses.—"Atony of large intestine and rectum, mucoid discharges, prolapsus ani, pruritis ani, ascaris vermicularis" (Scudder, *Dis. of Children*, 1882). Difficulty in evacuating the lower bowel.

ALOINUM (U. S. P.)—ALOIN.

"A neutral principle obtained from several varieties of Aloes, chiefly Barbadoes Aloes (yielding Barbaloin); and Socotra or Zanzibar Aloes (yielding Socaloin)—differing more or less in chemical composition and physical properties, according to the source from which it is derived"—(*U. S. P.*).

Preparation.—There are several methods of preparing this substance. One part of aloes may be dissolved in 10 parts of boiling water, the fluid portion decanted, and slightly acidulated with hydrochloric acid (Groves). Or the aloes may be previously made acid with sulphuric, hydrochloric, or sulphurous acid, and allowed to stand a half-day (Tilden). Then rapidly evaporate to 2 parts and set aside, that crystals may form. To purify, recrystallize from alcohol very much diluted. These methods answer well for barbaloin. Socaloin is best obtained by digesting for a day 1 part of aloes in 3 parts of alcohol, and then boiling the mixture on a water-bath for 2 hours. Cool, filter, and allow crystals to form, which are to be washed with a small portion of alcohol and then dried (Plenge, *Amer. Jour. Pharm.*, 1884).

Description and Tests.—Barbaloin, when pure, crystallizes in stellated groups of small, prismatic needles, whose purity is shown by the color, which should not deepen by exposure to the air in desiccation. Its solutions in the alkalies and their carbonates are orange-yellow, and the liquid absorbs oxygen upon contact with the atmosphere, which rapidly deepens its color. Boiled with alkalies or acids, it is speedily transformed into a brown resin. Corrosive sublimate, nitrate of silver, or neutral acetate of lead, do not cause its precipitation; concentrated subacetate of lead produces a precipitate of an intense yellow, soluble in excess of water, and becoming deeper colored on exposure. Cold fuming nitric acid dissolves it, without disengaging gas, forming a reddish-brown liquid; to which, if sulphuric acid be added in great excess, a yellow, pulverulent body is thrown down, which explodes when heated. By dry distillation, aloïn furnishes a slightly aromatic, volatile oil, and a quantity of resinous substance. It forms crystallized compounds with bromine, but not with chlorine, although it combines equally well with the latter. The official aloin may be either barbaloin or socaloin, or both. (For the chemistry of these substances, see under *Aloe*).

"Minute, acicular crystals, or a microcrystalline powder, varying in color from yellow to yellowish-brown, odorless, or possessing a slight odor of aloes, of a characteristic, bitter taste, and permanent in the air. Barbaloin is soluble at 15° C. (59° F.), in about 60 parts of water, 20 parts of alcohol, or 470 parts of ether. Socaloin is soluble in about 60 parts of water, 30 parts of absolute alcohol, 380 parts of ether, or 9 parts of acetic ether. When heated, aloin melts, and, on ignition, it is consumed without leaving a residue. An alcoholic solution of aloin is neutral to litmus paper. An aqueous solution of aloin is colored greenish-black by ferric chloride T.S., and slowly precipitated by basic lead acetate T.S. On adding a minute portion of barbaloin to a drop of cold nitric acid of specific gravity 1.200, on a white porcelain surface, a crimson color will be developed. Socaloin will produce scarcely any color when thus treated. In alkaline solutions, aloin is rapidly decomposed; in neutral, or acid solutions, only slowly"—*U. S. P.*).

Action, Medical Uses, and Dosage.—The action of aloin is similar to that of aloes, except that this agent will produce the effects of aloes in about one-third as large a dose, and is said to be freer from irritant effects. Dose: $\frac{1}{10}$ to $\frac{1}{2}$ grain.

ALSTONIA CONSTRICTA.—ALSTONIA BARK.

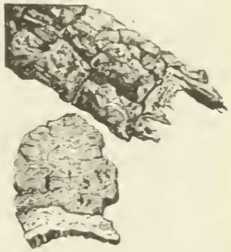
The bark of *Alstonia constricta*, F. Mueller.

Nat. Ord.—Apocynaceæ.

COMMON NAMES: *Native quinine of Australia, Australian fever bark, Fever bark, Bitter bark, Alstonia bark.*

Botanical Source.—The genus Alstonia comprises about twelve species, seven of them being given in Bentham's *Flora of Australia*. They are milk bearing shrubs or trees, with large, entire, generally whorled leaves, and terminal cymes of white flowers. *Alstonia constricta*, F. Mueller, is a lactescent, smooth tree, found growing only in Australia, and has large, opposite, entire oblong leaves about 4 inches long, borne on slender leaf-stalks. The flowers are small, white, numerous, and disposed in corymbose cymes. The calyx is deeply 5-parted and has ovate acute lobes. The corolla has a bell-shaped tube, about twice the length of the calyx, and 5 equal spreading lobes. The stamens are 5, distinct and included. The pistil consists of 2 carpels, with a single style. The fruit consists of a pair of slender, smooth pods, from 3 to 8 inches in length, and containing numerous, flat, pubescent seeds, the upper margins of which are fringed with long hairs.

Fig. 15.



Bark of Alstonia constricta.

Description, Chemical Composition, and History.—The bark is used in Australia as an antiperiodic. As found in commerce, it is in pieces varying in length from 6 inches to 2 feet, from ½ inch to 3 inches in thickness, and from 2 to 4 inches in width. That from the young trees or branches is often curled, like cinnamon bark, until the edges meet, or even overlap. The accurate description given by Mr. Chas. Mohr in the *Amer. Jour. Pharm.*, August, 1879 is as follows: "The bark occurs in semicircular pieces of various length, about 4 inches wide and from 1½ to 2 inches and over in thickness, according to the more or less exuberant development of the corky layers. The rough outer bark is furrowed by more or less broad and deep longitudinal fissures, presenting in the cross section a margin correspondingly deeply indented by irregular, more or less wide and deep sinuosities. The exposed surface of the bark is of a dingy gray-brown, and of an ochre color where fresh layers of cork are exposed. This outer bark, forming far the largest part, shows in the cross section a mottled yellow and brownish color, resulting from somewhat irregular, concentric layers of a clear ochry-yellow, alternating with bands of a deeper tint. It is of spongy texture and friable. The middle and inner layers, about ¼ of an inch in thickness, are compact and homogeneous in the cross sections, of a yellow color, and under the lens appearing punctate from the darker faces of the bast-bundles; of a fibrous structure, hard and tough, and on the inner side serrated by longitudinal ridges, caused by the impressions of the bast-bundles upon the cambial layer. The powder of the bark is of a dingy yellow, and possesses a faint, not unpleasant odor, and a lasting, purely bitter taste. The active principles are contained chiefly in the middle and inner bark."

This bark is of a comparatively recent introduction, having been shown for the first time in this country at the Centennial Exposition, in the Australian department, where it was asserted by its exhibitors to be a remedy for malarial fevers. A Cincinnati gentleman, having had his attention strongly attracted toward these assertions, procured a specimen of the bark and, after investigation, having found it to possess therapeutical virtues, he ordered a supply from Australia, intending to introduce it as a proprietary medicine. Prof. J. M. Scudder, of Cincinnati, persuaded him, however, to give up his intention, and allow it to come before the medical profession under its true name, *Alstonia constricta*, the positive identification of which Mr. Charles Mohr effected through specimens sent by him to Sir Joseph Hooker.

The chemical constituents have been investigated repeatedly. *Alstonine* (*chlorogenine* of Hesse), is the name given in Wittstein's *Organic Constituents of Plants*, for an orange-yellow, amorphous alkaloid, isolated by Mueller and Rummel. Mohr (1879) found a substance agreeing with that of M. and R. in all respects, and announced the probable presence of another proximate constituent; but want of material prevented a thorough examination. Oberlin and Schlagdenhauffen (*Pharm. Jour. and Trans.*, June, 1879, from "*Jour. de Pharm. et de Chimie*"). report an analysis of the bark, and the isolation of two alkaloids: One, *alstonine*, in crystalline tufts, bitter, colorless, soluble in alcohol, chloroform, and benzin; insoluble in cold, but somewhat in boiling water; soluble in nitric, hydrochloric and sulphuric acids, without color, but which neutralizes acids, changes red litmus paper to blue, and the acid solutions of which produce fluorescent (blue) liquids. The other, "*alstonicine*," is amorphous, and is obtained from the mother liquor after the production of *alstonine*. It somewhat resembles alstonine, but is not as soluble in boiling water, turns a red-crimson color with nitric, and greenish-brown with sulphuric and hydrochloric acids, and the acid solutions are not fluorescent. In 1880, Hesse established with certainty the presence of the following three alkaloids: *Alstonine* ($C_{21}H_{20}N_2O_4$), identical with his chlorogenine of 1865 and the alstonine of Palm (1863); orange-yellow, not easily soluble in water, easily soluble in alcohol, chloroform, ether and dilute acids, the solutions having blue fluorescence. *Porphyrine* ($C_{21}H_{25}N_3O_2$), is white and non-crystalline; dissolves in concentrated sulphuric acid with purple color, the acid solutions being fluorescent, with blue color. *Alstonidine*, less soluble in petroleum benzin than porphyrine. Hesse indicated the existence of other alkaloids besides those mentioned. All reports agree, however, that these proximate principles exist in very small amount. Doubtless, either the bark in substance, or the tincture, or the fluid extract, will be the medicinal preparations employed; the most effectual being prepared from the *inner* bark.

Von Mueller appears to have been the first person who made known the febrifuge properties of this bark, in 1870, in an address before the Industrial Museum of Melbourne; in 1874, in a published statement relative to certain select plants, he again remarks that the bark of *A. constricta* is aromatic, bitter, and regarded as valuable in ague; also as a general tonic. It was subsequently referred to as an antiperiodic, in 1876, by Dr. A. Cathcart, of South Wales. Its introduction to the materia medica of this country justly belongs to Prof. J. M. Scudder, M. D., of Cincinnati. It is said that English brewers substitute it for hops in the making of pale export beer, for, unlike the hops, it will not produce headache (Christy). A decoction of fever bark is sold in some of the English colonies as "bitters."

Action, Medical Uses, and Dosage.—The inner bark of Alstonia constricta is said to possess marked antiperiodic properties, while the outer bark is stated to have been efficacious in curing certain forms of *rheumatism*. Further trials are needed, however, before it can be ranked as a substitute for quinine, or other of the cinchona alkaloids, yet it has proved as efficient in *intermittents*. "Hesse attributes to alstonidine properties analogous at once to those of quinine and to nux vomica. The experiments of Bancroft and of Bixby prove that this drug is valuable as a tonic febrifuge, and more valuable as a febrifuge than as a tonic, while the Alstonia scholaris is more generally employed against dysentery" (Beringer, *Amer. Jour. Pharm.*, 1895, p. 167).

Prof. King has used the bark in several cases with prompt and decided success; four of these cases were small children. The inner bark was given to the patients in a dose of from 4 to 8 grains, an hour or two before the expected chill, repeating the dose 2 or 3 times, each time anterior to the anticipated chill. Three doses were usually required; in one case, only 1 dose was given, and in two others, 4 doses were taken before the chills disappeared. The most marked influence was in an obstinate case, tertian, invariably attended during the attacks with gastric pain and irritability, and neuralgic pains in the superior extremities; the first dose afforded much relief, and since the third dose the patient has been entirely free from any symptoms of the malady, and has, for the first time in several years, passed an autumnal season without any chills, while neighbors were suffering more or less severely from them. Professor Locke has used it successfully in *chronic intermittent*, but thinks it not so efficacious in the acute forms. Prof. J. M. Scudder also had considerable success with it. He regarded it an excellent tonic and restorative when the secretions are depraved, the bowels irregular, tongue inclined to be dirty, skin dirty and sallow, and the urine depositing a sediment (*Spec. Med.*, 69). Many physicians have reported favorably as regards its antiperiodic virtues, having successfully used it where quinine had failed. From the fact that it corrects depraved states of the blood in malarial disorders, Webster contends that it should not be termed an antiperiodic, but rather a corrective of malarial cachexia. Dr. John Fearn favors its use in *chronic malarial poisoning*, and gives as its specific indications: Tongue dirty, skin sallow, and urine turbid, with periodicity. Gastro-intestinal disorders, depending upon chronic malaria, such as *lienteric diarrhœa*, *dysentery*, and *atonic dyspepsia*, are reputed to be cured by it. According to Dr. R. E. Kunze, of New York City, this bark possesses slightly narcotic, cerebro-stimulant, antiperiodic, febrifuge, and tonic properties; he has used it with success in several cases of intermittent fever, though, from its peculiar effects in certain cases, he is rather inclined to consider its use contraindicated in "patients of a delicate and highly nervous organization." Among the patients with whom it has acted favorably, it not only checks the ague, but appears also to prevent its return, for the season, at least. The bark is very bitter, and produces different effects with different parties; among these effects may be named a persistent disagreeable taste, more or less nausea or a sense of disgust, dizziness, pain in the forehead and occiput, tinnitus, weight in the epigastrium, etc. With many, the only appreciable symptoms noticed are the unpleasant taste left in the mouth and fauces, and the prompt disappearance of the chills. The dose of the bark, which should be well masticated, is from 2 to 8 grains; but the more desirable form for administration and efficacy appears to be the powdered bark, in capsules, 2 to 5 grains every 3 or 4 hours; as a tonic, grain doses. Of the tincture the dose will vary from 10 to 60 minims every hour or two, and should be given on the days of the attack, commencing several hours before the expected chill. This is certainly an agent that should be thoroughly tested by the profession.

Specific Indications and Uses.—Chronic malarial cachexia and gastro-intestinal disorders depending thereon, with dirty, sallow, or tawny skin, and dirty, pasty tongue; the urine is turbid and cloudy, with urinary deposits. Periodicity, with exacerbations, and remissions, or intermissions.

Related Species and other Antiperiodics.—*Alstonia spectabilis*, R. Brown. *Poelé-bark.* Java. Contains, according to Hesse, a much larger proportion of alkaloids than the other Alstonias. Yields *echitamine* and *alstonamine* (alstonine of Scharlée). *Wrightia antidysenterica*, R. Brown (*Holarrhena antidysenterica*, *Nerium antidysentericum*, Linné). *Nat. Ord.—Apocynaceæ. Conessi bark, Codaga pala, Tellicherri bark.* A rusty-hued, spongy, bitter bark, formerly much employed on the continent in *dysentery* and *diarrhœa*, and still in use in India. Haines (1858) extracted an impure alkaloid from it, which Stenhouse afterwards obtained pure. The former named it *conessine;* the latter, *wrightine.* Its composition has been variously given, and the name *kurchicine* has also been applied to it. It is amorphous, white, bitter, soluble in alcohol, diluted acids, and ether. As obtained and put on the market by Merck, it forms delicately interlaced crystalline masses. *Holarrhena africana* contains a similar alkaloid, and is used in Africa as a remedy for *dysentery.*

Picrorrhiza Kurroa, Royle. India. The root of this plant, known as *kali kutki*, is used in India as a mild aperient and bitter stomachic. According to Dymock (*Mat. Med. Western India*), it is a powerful tonic, and is of much value as an antiperiodic, its slightly laxative qualities rendering it doubly efficient.

Echites species.—Several species of Echites are used in India and South America. They and their uses are as follows: *Echites syphilitica*, Linné filius. Surinam. Used in *syphilitic disorders. Echites antidysenterica*, Roxburgh, *Echites pubescens*, Buchanan, *Echites longiflora*, Desfontaines, *Echites Curura*, Martius, and *Echites insignius*, Sprengel; bark used in *dysentery* and *diarrhœa. Echites caryophyllata*, Roxburgh; leaves used in *arthritic febrile complaints. Echites malabarica*, Lamarck; root employed in *fevers*, and leaves topically to *carbuncles.*

ALSTONIA SCHOLARIS.—DITA BARK.

The bark of *Alstonia scholaris*, R. Brown.

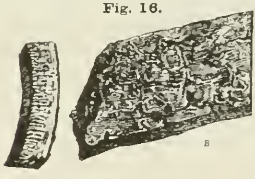
Nat. Ord.—Apocynaceæ.

COMMON NAMES: *Dita bark, Devil tree of India.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 173.

Botanical Source.—Alstonia scholaris (Dita bark), is found throughout tropical Eastern Asia and the Malayan Archipelago (Bentham). It is a large tree, with smooth, entire, thick leaves disposed in whorls. The flowers resemble those of *Alstonia constricta*, but differ in having corolla tubes about three times as long as the calyx, and shorter pubescent lobes. The pods are slender and over a foot long. Don says it is a native of the East Indies and the Moluccas; the bark met with in commerce comes from the Phillippine and neighboring islands, and is the portion used in medicine. The local name of the bark is *satween.* As a remedial agent *dita* is old, having been mentioned, it is said, by Rheede (1678), and Rumphius (1741).

Fig. 16.



Bark of Alstonia scholaris.

Description.—Dita bark is about ½ inch thick, and is found in market in irregular sizes from 1 to 2 inches wide, and from 3 to 6 inches long. Externally it is of a mottled pinkish or brownish and white color, rather smooth, but marked by shallow fissures which are raised upon the edges and scarcely extend through the corky layer. The cork, a very thin layer, represented by the dark edge of the section *b* of our engraving, is brown. Internally, the color of the bark is light, slightly striated with yellowish layers or grains. In texture it is granular and brittle, resembling wild cherry bark from old trees. The taste is slightly bitter, free from astringency, not unpleasant, and may be compared to the aftertaste of wild cherry bark, and in like manner the bark is gritty between the teeth.

Chemical Composition.—According to Husemann, Scharlee, in 1863, published an article on the preparation of an alkaloid which he named *alstonine*. Gruppe found in it about 2 per cent of a substance which possessed febrifuge powers, and he named it "ditain." It was prepared, according to Hildwein, in a manner similar to that used in making quinine; it is not an alkaloid, but a mixture of substances, as was verified by Gorup-Besanez, who found it to contain a crystallizable substance possessing the properties of an alkaloid. Jobst and Hesse (1875), separated the true alkaloid, *ditamine* ($C_{16}H_{19}O_2$), from the bark, as a white amorphous powder, slightly bitter, soluble in ether, chloroform, benzene, and alcohol, being alkaline in reaction from the latter solution. It forms soluble salts, with diluted acids, which are very bitter; it dissolves with a reddish color, in sulphuric acid, and yellow in nitric acid, turning dark green at first when heated, then orange-red, with evolution of fumes of the same color. It was obtained only in about 0.02 per cent of the bark operated upon, and on this account can never be expected to come into general use as a febrifuge. A second alkaloid, *ditaine* (crystallizable) was obtained by Harnack in 1877, for which Hesse, in 1880, found the formula $C_{22}H_{28}N_2O_4$, and changed the name to *echitamine*. Besides, Hesse discovered a brown amorphous alkaloid which he named *echitenine* ($C_{20}H_{27}NO_4$). In addition, there are present oxalate of calcium, fatty acid, crystallizable acid, and several fatty resinous substances called: *Echicaoutchin* ($C_{25}H_{40}O_2$); *echicerin* ($C_{30}H_{48}O_2$); *echitin* ($C_{32}H_{52}O_2$); *echitein* ($C_{42}H_{70}O_2$); *echiretin* ($C_{35}H_{56}O_2$). These substances closely resemble resins obtained from other sources. Doubtless, the bark, if employed in medicine, will be either used in substance or in the form of tincture or fluid extract, as the proximate principles can not become of much commercial importance.

History.—In Ceylon coffins are made of this light wood (*Treasury of Botany*). According to Drury, the name "scholaris" is derived from the fact that its planks, when sanded, were used by school children for tracing letters. It is largely used in India for skin disorders (Dutt, *Hindu Mat. Med.*), and as a febrifuge. According to Graham, the natives have a superstitious reverence for this tree, believing that all the forest trees assemble once a year to pay homage to it (Dymock). This bark is largely used by the natives of India (where it is official in the Pharmacopœia), as a remedy for bowel disorders, and to restore the tone of the gastro-intestinal tract after exhausting sickness, as from fever (Maiden). Woolen and cotton cloths are dyed various shades of yellow with this bark (Baron von Mueller's Exhibit, Melbourne, 1866).

Action, Medical Uses, and Dosage.—Dita bark has been efficaciously employed in *malarial fever*; it does not, however, appear to be as prompt nor as active in its influence as the alstonia constricta bark, requiring to be used in somewhat larger doses. Alstonia scholaris has some reputation as a remedy for *dysentery* (Bancroft, Bixby). Its alkaloid may prove more efficient should it ever become more largely and less expensively prepared. Dose of the fluid extract, 1 to 4 fluid drachms.

ALTHÆA (U. S. P.)—ALTHÆA.

"The root of *Althæa officinalis*, Linné"—(*U. S. P.*).

Nat. Ord.—Malvaceæ.

COMMON NAME: *Marshmallow*.

ILLUSTRATIONS: Bentley and Trimen, *Med. Plants*, 35; Woodville, *Med. Bot.*, 198.

Botanical Source.—Althæa officinalis is a peculiarly soft and downy, hoary, green herb, having a tap-shaped, rather woody root. It has several erect, simple stems, from 2 to 5 feet in height, round, leafy, tough, and pliant; the leaves are ovate or heart-shaped at the base, of various breadths, plaited, 5-ribbed, unequally serrated, petioled, soft and pliable, and more or less deeply divided into 5 acute lobes. The flowers are large, in very short, dense, axillary panicles, rarely solitary, of a delicate, uniform, blush color. The involucre has 8, 9, 10, or 12 divisions. The 1-seeded fruit is formed of numerous capsular carpels, closely and circularly arranged around the axis.

History and Description.—This perennial herb is found commonly on the banks of rivers, and in salt marshes. It is indigenous to Europe, and portions of Asia, in some parts of which it is cultivated in great quantities for medical use; and moist, sandy soils are preferred. It flowers from July to September. The whole plant, but especially the root, abounds with mucilage. Although the plant grows to some extent in the United States, the root is principally obtained from Europe for medical purposes, that which comes from Germany being much whiter but not so thick as that from the south of France. As found in commerce, the root is in pieces 3 or 4 inches long, or more, roundish, about ½ inch in diameter, with a feeble odor and very mucilaginous taste. It should be chosen plump, and little fibrous; with a very white surface, well cleared of its yellowish epidermis, downy from the mode of dressing it with files; and possessing no moldy, acid, nor musty odor, and no acid taste. Sometimes it is met with divided lengthwise. The plant contains nearly 20 per cent of mucilage—(*Ed.*, Duncan). Both the flowers and leaves are occasionally employed by the Europeans. The root should be gathered in the early spring or autumn of the second (not later than the third) year's growth, and only the fleshy portions retained, the older, woody roots being valueless.

The *Pharmacopœia of the United States* directs that Althæa shall conform to the following description: "In cylindrical or somewhat conical pieces, from 10 to 15 Cm. (4 to 6 inches) long, 10 to 15 Mm. (.039 to .059 inch) in diameter, deeply wrinkled; deprived of the brown, corky layer and small roots; externally white, marked with a number of circular spots, and of a somewhat hairy appearance from the loosened bast fibres; internally whitish and fleshy. It breaks with a short, granular, and mealy fracture, has a faint, aromatic odor, and a sweetish, mucilaginous taste"—(*U. S. P.*).

Chemical Composition.—Althæa-root contains starch, pectin, mucilage, sugar, lignin, calcium phosphate, fixed oil, a viscid material, and *asparagin* (A. Buchner). *Asparagin* ($C_4H_8N_2O_3.H_2O$), is a colorless, crystallizable body, without taste or odor. Ether and alcohol do not dissolve it, but it is extracted from the root with water, from which it may be crystallized by concentrating the solution. Its reactions prove it to be *amido-succinamic acid*, having the formula: $CO_2N.CH_2.CHNH_2.CONH_2$. When boiled with acids or alkalies, it splits into ammonia and *amido-succinic acid* or *aspartic acid* ($C_4H_7NO_4$). Asparagin is distinguished by its optical activity, being lævo-rotatory in aqueous solution, which changes to dextro-rotatory by the action of acetic acid. Asparagin, when pure, is stable in solution, but is susceptible to fermentation in the presence of albuminoid substances, whereby it is converted into ammonium succinate.

Asparagin was discovered by Vauquelin and Robiquet, in 1805, in the juice of the asparagus plant, and in the marshmallow root, as *althein*, by M. Bacon, in 1826. It is identical with *agedoite*, found by Caventou in liquorice root (*Jour. de Pharm.*, xiv., 177), and is found in many other plants, *e. g.*, comfrey, dahlia, potatoes, the roots of *Robinia Pseudacacia*, etc. The mucilage (free from starch) of the root is extracted with cold water; the starch by boiling water.

Action, Medical Uses, and Dosage.—The root of this plant, as well as of each of the below mentioned plants described as substitutes, is demulcent and diuretic, and may be used indiscriminately, the one for the other. They will be found valuable, in the form of decoction, in diseases of the mucous tissues, as *hoarseness*, *catarrh*, *pneumonia*, *gonorrhœa*, *vesical catarrh*, *renal irritation*, *acute dysentery*, and *diarrhœa*. In *strangury*, *inflammation of the bladder*, *hematuria*, *retention of urine*, some forms of *gravel*, and indeed in nearly every affection of the kidney and bladder, their use will be found advantageous. Much use is made of them combined with equal parts of spearmint, in *urinary derangements*. They are likewise efficacious in *gastro-intestinal irritation and inflammation*. As the decoction soon decomposes, or becomes moldy or acid, it should always be made in small quantities, not more than 1 or 2 pints at a time, according to the temperature of the weather. Externally, marshmallow root is very useful in the form of poultice, to discuss painful, *inflammatory tumors*, and *swellings* of every kind, whether the consequence of *wounds*, *bruises*, *burns*, *scalds*, or *poisons;* and has, when thus applied, had a happy effect in preventing the occurrence of *gangrene*. The infusion or decoction may be freely administered.

Related Species.—*Althæa rosea*, Cavanilles (*Alcea rosea*, Linné). *Common garden hollyhock.* Native of China. Cultivated for its beauty in gardens. The flowers, capsules, and root are used for similar purposes as the marshmallow. The purple flowers are preferred, a concentrated infusion of which colors white bibulous paper a fast purple-blue, which is turned a blue-green by alkalies, and red with acids. The root contains a considerable amount of mucilage, and is sometimes used as an emollient and demulcent.

Althæa taurinensis, De Candolle. South Europe. Use, same as of *Althæa officinalis.*

Malva sylvestris, Linné. *Common mallow.* This is a perennial, hairy herb, sometimes called *High-mallow*; has a tapering, branching, whitish root, and an erect, round stem 2 or 3 feet high. Leaves alternate, deep-green, soft, downy, serrated, plaited, with 7 acute lobes, on hairy petioles; uppermost with fewer, but deeper and more acute lobes than the lower ones. Flowers large, numerous, of a shining purple, veiny, on simple, aggregate, hairy axillary stalks. Calyx 5-cleft. Petals 5, inversely cordate, thrice the length of the calyx. Stamens indefinite, monadelphous. Pollen large, whitish. Ripe carpels reticulated at the back.—L.—G.).

Malva rotundifolia, Linné. *Low-mallow*, or *Round-mallow*, called by children who are fond of eating the fruit, *cheeses;* has a fusiform root and prostrate stem; leaves of a fine, delicate texture, roundish, cordate, or somewhat reniform, crenate, obtusely 5 or 7-lobed, on long, hairy petioles. Flowers pale-pink, deeply-notched petals, on aggregate, axillary peduncles. Fruit depressed-globose, composed of the numerous carpels arranged circularly (W.).

The *M. sylvestris* is a native of Europe, and is naturalized in this country, growing abundantly in fields, roadsides, and waste places, and flowering from May to October. The whole plant, especially the root, abounds in mucilage. The *M. rotundifolia*, a very common, troublesome plant, growing around dwellings and in cultivated grounds together with other species of this genus, possesses similar properties, and they may be substituted for each other. The herb and flowers are inodorous, with a weak, herbaceous, mucilaginous taste. Water extracts their mucilage, and acetate of lead precipitates the solution. The root and seeds may be also used, as they contain much mucilage. The blue infusion, or tincture of the flowers, is turned green by alkalies, and red by acids, thus forming an exceedingly delicate indicator. Mallows possesses the properties common to mucilaginous herbs. An infusion forms an excellent demulcent in *coughs*, *irritations of the air passages*, *flux*, *affections of the kidneys and bladder*, etc. It may also be used in injection. The herb, bruised, forms a good emollient cataplasm to *boils* and *inflammatory conditions* of external parts. Low-mallows makes a good ointment for use on *sores* in horses.

Malva vulgaris, Fries. (*Malva neglecta*, Wallroth). Europe. Together with leaves of *M. sylvestris*, the source of German official *Mallow-leaves.*

Abutilon Avicennæ, Gærtner. (*Sida Abutilon*, Linné). *Indian mallows. Velvet leaf.* Indigenous to the Levant. Naturalized in Europe and the United States, where it is a common weed. Emollient and diuretic. Cultivated in China as a substitute for hemp.

Hibiscus Moscheutos, Linné. (*Hibiscus palustris*). *Marsh rose hibiscus.* U. S. Marsh hibiscus has a root very much resembling that of the Marshmallow, possesses exactly the same properties, and may be as effectually used. It is a tall, showy, perennial plant, growing in salt marshes, near salt springs, and on wet prairies, and flowers in August.

Hibiscus virginicus, *Sweat weed.* Marshes along the Atlantic from New York southward. Has the mucilaginous properties of the Altheas.

Hibiscus esculentus, Linné. (*Abelmoschus esculentus*, Guillemin and Perrotett). (See *Hibiscus*).

Abelmoschus moschatus, Moench (*Hibiscus Abelmoschus*, Linné). (See *Hibiscus*).

Hibiscus Rosa-Sinensis, Linné. *China rose.* The bark of the stem is reputed emmenagogue, while the root is employed in the Eastern world like Marshmallow. It is a cultivated species.

Hibiscus Sabdariffa, Linné. Africa. *Red sorrel.* Cultivated in tropical climes. It is known in the Mexico-Texan regions as *Jamaica*. The calyx, which contains mucilage, malic, tartaric, and possibly oxalic acids, in a free state, is the part employed.

Sida floribunda, Peru. Contains an abundance of mucilage. The leaves, which are thickly beset with minute, stiff spines, are reputed a mechanical vermifuge (Martinet).

Sida rhombifolia. Queensland hemp. Jelly leaf. Contains an abundance of mucilage, and is employed as a poultice and a remedy in *respiratory complaints.*

Species.—Species Pectorales (N. F.), *Pectoral species. Species ad infusum pectorale. Breast tea.* (*German Pharmacopœia*). *Formulary number*, 344: "Althæa, peeled, 8 parts; coltsfoot leaves, 4 parts; glycyrrhiza, Russian, peeled, 3 parts; anise, 2 parts; mullein flowers, 2 parts; orris root, 1 part. Cut, bruise, and mix them. *Note.*—Coltsfoot leaves are derived from *Tussilago Farfara*, Linné. Mullein flowers are from *Verbascum Thapsus*, G. Meyer. *Infusum pectorale* (pectoral infusion, or infusion of pectoral species), is made by infusing 1 troy ounce of the above preparation, in the usual manner, so as to obtain 10 fluid ounces of strained product"—(*Nat. Form.*). As the name of this preparation implies, it is employed by the Germans in various *pulmonic complaints*, attended with cough.

Species Emollientes (N. F.), *Emollient species. Emollient cataplasm.* (*German Pharmacopœia*). *Formulary number*, 342: "Althæa leaves, mallow leaves, melilot tops, matricaria, flaxseed, of each, equal parts. Reduce them to a coarse powder, and mix it uniformly. *Note.*—Mallow leaves are derived from *Malva vulgaris*, Fries, and *Malva sylvestris*, Linné. Melilot tops are the leaves and flowering branches of *Melilotus officinalis*, Desrousseaux, and *Melilotus altissimus* Thuilliers"—(*Nat. Form.*). This is designed for the ready preparation of an emollient poultice for various *inflammations*, *swellings*, etc.

ALUMEN.–(U. S. P.)—ALUM.

I. ALUMEN, U. S. P. (ALUMINII ET POTASSII SULPHAS).
FORMULA: $Al_2K_2(SO_4)_4+24H_2O$. MOLECULAR WEIGHT: 946.46.
SYNONYMS: *Alum, Potash alum, Potassium alum.*
II. ALUMINII ET AMMONII SULPHAS.
FORMULA: $Al_2(NH_4)_2(SO_4)_424H_2O$. MOLECULAR WEIGHT: 904.42.
SYNONYMS: *Alum, Ammonia alum, Ammonium alum.*

Source.—These salts are double sulphates of aluminum and an alkali manufactured from clay, from alum stone (*alunite*), from cryolite, and from aluminous schist, or alum slate, often containing pyrites. Common alum (potash alum) is chiefly found in volcanic countries, in the earth of which it exists naturally.

Preparation.—Alum is prepared in several ways. Pipe-clay (aluminum silicate), which should contain but little iron, is calcined and then mixed with hot sulphuric acid until a paste-like magma results; the mixture then being exposed to the atmosphere, will be gradually changed to aluminum sulphate. If this be mixed with either sulphate of potassium or ammonium in solution, alum will be deposited in crystals. To render the combination of the acid less difficult, the clay is sometimes heated in a reverberatory furnace with from 10 to 20 per cent of charcoal or gas coke. Again, when *alum-stone*, which contains the elements of alum (potassium sulphate and aluminum sulphate), combined with hydroxide of aluminum, is roasted, thrown into piles, and kept moist for a number of months, it will be found to have been changed to alum, which may be readily obtained by lixiviation with water and then crystallized. This calcined *alunite*, or alum-stone, yields a very pure alum. To obtain it from *aluminous schist*, or alum slate, which is principally aluminum silicate (clay), containing iron sulphide, bitumen, and lime and manganese in small amounts, the slate, if dense, is piled in alternate layers with wood or coal, and slowly calcined; or if the slate be not too compact, the roasting is dispensed with and the slate is at once subjected to the process of weathering. The shale is crushed, thrown into heaps, and exposed to the air for an extended length of time—sometimes for years. By oxidation, iron sulphide is converted into ferric sulphate and sulphuric acid, which acts upon the aluminum silicate, converting it into aluminum sulphate. The mass is then lixiviated. To the concentrated solution, while hot, is added potassium chloride (obtained from waste in soap-boiling, and from nitre works), which combines with the iron sulphate, yielding chloride of iron and sulphate of potassium. The iron salt remains in solution while the alum formed separates as a powder when the liquor cools. The alum is then purified by recrystallizing several times, the last operation being conducted in large retainers, which may easily be taken apart so as to detach the alum crystals. This process yields potash alum. If, however, ammonium sulphate be used instead of potassium chloride, ammonia alum is the result. The ammonium sulphate is usually obtained from the refuse of gas works.

Alum is extensively made by treating the mineral, cryolite, with concentrated sulphuric acid, applying heat to it, and then washing out the sodium sulphate formed, with cold water. The resulting aluminum sulphate is dissolved in hot water, and to the solution is added ammonium or potassium sulphate. The alum is then crystallized. The only alum now recognized by the *U. S. Pharmacopœia* is the potash alum. Both alums in commerce contain a variable portion of iron, not more than 8 per cent, which may be detected by potassium ferrocyanide, which produces with the alum solution a bluish coloration.

Description.—The official Alum (potassium alum), is thus described by the Pharmacopœia: "Large, colorless, octahedral crystals, sometimes modified by cubes, or in crystalline fragments, without odor, but having a sweetish and strongly astringent taste. On exposure to the air, the crystals are liable to absorb ammonia, and acquire a whitish coating. Soluble in 9 parts of water at 15° C. (59° F.), and in 0.3 part boiling water; it is also freely soluble in warm glycerin, but is insoluble in alcohol. When gradually heated, it loses water; at 92° C. (197.6° F.), it melts, and if the heat be gradually increased to 200° C. (392° F.), it loses all its water of crystallization (45.52 per cent of its weight), leaving a voluminous, white residue. The salt has an acid reaction on litmus paper"—(*U. S. P.*). Its density is 1.724. A very strong heat expels its acid. Ether refuses to dissolve it. Alum in solution is precipitated by potassium and sodium hydrates; also by aqua ammoniæ and alkaline carbonates. The precipitate, $Al_2(OH)_6$ (see *Alumini Hydras*), is easily soluble in excess of potassium or sodium hydrate, but not of ammonium hydrate, forming *aluminates* of these metals ($Al_2O_4Na_2$ or $Al_2O_4K_2$), and may be reprecipitated by boiling the solution with ammonium chloride; also carbonic acid gas decomposes the aluminate. As the physical properties of both the ammonium and potassium alum are identical, a description of the one will answer for that of the other. The ammonium alum may be differentiated from the potassium alum by adding to it an excess of alkali and heating, whereupon ammonia gas will be evolved, which may be known by its odor. If the same be heated to complete redness, alumina is produced. If potassium alum be mixed with powdered charcoal and heated without access of air, in a flask or retort, an inflammable powder, capable of spontaneous ignition upon exposure to the atmosphere, is produced. This is known as *Homberg's pyrophorus*, and is a mixture of charcoal, potassium sulphide, and alumina. A solution of alum dissolves the metals usually dissolved by weak sulphuric acid. Ammonium alum has a density of 1.631 and contains 47.6 per cent of water of crystallization, which is completely expelled when heated higher than 205° C. (401° F.).

Tests.—For *Alumen* (*U. S. P.*): "The aqueous solution of the salt affords, with ammonia water, a white, gelatinous precipitate, which is nearly insoluble in excess of ammonia. Another portion of the aqueous solution yields, with barium chloride T.S., a white precipitate, insoluble in hydrochloric acid. When a saturated solution of the salt is actively shaken with tartaric acid T.S., it affords, within half an hour, a white, crystalline precipitate. The aqueous solution of alum affords, with potassium or sodium hydrate T.S., a white, gelatinous precipitate, which is completely soluble in an excess of the alkali, and this alkaline solution should not evolve the odor of ammonia, even when heated (distinction from and absence of ammonium alum). A 5 per cent aqueous solution of the salt should not be affected by hydrogen sulphide T.S. (absence of copper, lead, or zinc), and 20 Cc. of this solution should not at once assume a blue color on the addition of 5 drops of potassium ferrocyanide T.S. (limit of iron)"—(*U. S. P.*).

ALUMEN EXSICCATUM (U. S. P.), *Dried Alum*. (*Alumen ustum, Burnt alum*). Formula: $Al_2K_2(SO_4)_4$. Molecular weight, 515.42. *Preparation*: Take "Alum, in small pieces, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; to make fifty-five grammes (55 Gm.) [1 oz. av., 411 grs.]. Place the alum in a shallow porcelain capsule so as to form a thin layer, and heat it on a sand-bath until it liquefies. Then continue the application of a moderate heat, with constant stirring, until aqueous vapor ceases to be disengaged, and a dry, white, porous mass is obtained, weighing fifty-five grammes (55 Gm.) [1 oz. av., 411 grs.]. When cold, reduce the product to a fine powder, and preserve it in well-stoppered bottles"—(*U. S. P.*).

Description: "A white, granular powder, without odor, possessing a sweetish, astringent taste, and attracting moisture on exposure to the air. It is very slowly, but completely, soluble in 20 parts of water at 15° C. (59° F.), and quickly soluble in 0.7 part of boiling water. Its aqueous solution should respond to the reactions and tests of alum (see *Alumen*)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—ALUMEN. Alum corrugates and constricts the organic fibres, condensation probably being due to its power of coagulating albumen. It contracts the capillaries and coagulates the blood, and is therefore very useful in *passive hemorrhages*. In large doses it may act as a gastro-intestinal irritant. An ounce in solution killed a man, severe gastro-intestinal burning and pain being experienced and inflammation induced. In doses of from 30 to 60 grains, repeated every 3 or 4 hours, alum exerts a purgative influence; if these doses are repeated every 10 or 15 minutes, they will cause vomiting. From 5 to 20 grains, dissolved in some aromatic infusion, and repeated every 3 or 4 hours, will exert an astringent-tonic influence. As an astringent, alum has been used in *passive hemorrhages* and immoderate secretions, as in *diarrhœa* attending *typhoid fever*, *night sweats* of exhausting diseases, *passive bleeding from the lungs* (best by spray), *stomach*, *kidneys* or *uterus*, *fluor albus*, etc. In the inflammatory stage of *gonorrhœa*, it will often be found useful in solution with an infusion of marshmallow. In *colic*, it has been found very useful when given in large doses, especially in that form of colic to which workers in lead are subject. In *spasm of the glottis* and *diseases of the throat*, accompanied with membraniform exudation, it is advised in emetic doses. It should only be used in croupous complaints when the secretions are free and loose. As an anti-spasmodic, it appears to exert a beneficial influence in *pertussis*. In several affections of the throat, alum, in solution, may be beneficially employed as a gargle, or it may be finely powdered, and blown upon the parts through a quill or small tube; thus used it will be found valuable in *sore throat*, *relaxed uvula*, etc. In the form of powder spray it will be found especially useful in many chronic mucous diseases, as in *congestion*, *catarrhal affections*, *chronic angina*, *thickening of the mucous tissue*, etc. Its solution may also be used as a wash for *ptyalism*, and as an injection in *gleet* and *leucorrhœa*, alone or conjoined with sulphate of zinc. It has likewise proved very useful in *purulent ophthalmia of infants*, and in the later stages of *conjunctival inflammation*. The crystal (pencil), once much employed in conjunctival diseases, is not much used at present. In *colica pictonum*, it may be given in doses of from 30 to 60 grains, every 3 hours; it mitigates all the unpleasant symptoms of this disease more promptly and permanently than any other remedy. Singularly, it will relieve some cases of *obstinate constipation*. These cases are chiefly those in which there is marked atony, due to habitual distension of the bowels with gas. R Alum, grs. ij to iij; aqua, fl℥iv. Mix. Sig. Teaspoonful every 2 hours. It is often used externally, either in powder or solution, to check *bleeding from the nose*, *excessive menstruation*, and to check the *bleeding* from cut surfaces; it may be applied on lint, or on a small piece of sponge if used in solution. From 4 to 10 grains of alum to 1 ounce of water, is of sufficient strength for a collyrium. To use in the form of spray in *faucial*, *tracheal*, *laryngeal*, and *nasal affections*, a solution of from 4 to 15 grains of alum to 1 fluid ounce of water may be used. I have found much advantage from the use of the following preparation in troublesome *cough*, especially when attended with tickling or irritation of the fauces, larynx, etc.: Take of a saturated solution of alum, syrup of balsam of tolu, each, 2 fluid ounces; camphorated tincture of opium, 1 fluid ounce. Mix. The dose for an adult is a tablespoonful 3 or 4 times a day, or whenever the cough is very troublesome (Prof. John King, M. D.). *Vulvar pruritis*, *inflammation of the vulva* in the young, and *leucorrhœa* are well treated with alum. In the latter complaint use a solution of borax one day, and one of alum the next (Locke).

ALUMEN EXSICCATUM. Dried or burnt alum, (*Alumen ustum*), is principally used as a mild escharotic, to destroy *exuberant spongy granulations*, known as proud flesh. It differs from alum only in the absence of water, being therefore more powerful, and may, like it, be used in form of powder spray.

ALUM WHEY, is made by boiling alum with milk, in the proportion of 5 grains of the former to every fluid ounce of the latter, and then straining off the thin liquor (C.). It may be given internally, in *diarrhœa*, etc., in doses of from ½ ounce to 1 or 2 ounces. Externally, applied over the eye as a poultice, it is very serviceable in inflammation of that organ.

ALUM CURD, is prepared by mixing 30 grains of alum with the white of an egg. It is of value in *conjunctival inflammations*, and as an application to the face when *poisoned by Rhus Toxicodendron*.

ALUMINI HYDRAS (U. S. P.)—ALUMINUM HYDRATE.

FORMULA: $Al_2(OH)_6$. MOLECULAR WEIGHT: 155.84.

SYNONYMS: *Aluminum hydroxide*, *Hydrated alumina*.

Source.—Aluminum hydroxide is found in ashes of cryptogamous plants, being most plentiful in certain lycopodiums. It occurs native in some rare minerals, as *gibbsite* ($Al_2[OH]_6$), and *diaspore* ($Al_2[OH]_2O_2$), the former in America, the latter in Europe. The alkalies and their carbonates precipitate salts of aluminum from solution; in this way aluminum hydrate is prepared for medicinal use. It may be obtained from cryolite as a by-product in the manufacture of sal soda (sodium carbonate) from this source (see *Sodii Carbonas*).

Preparation.—"Alum, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; sodium carbonate, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; distilled water, a sufficient quantity. Dissolve each salt separately in one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of distilled water, filter each solution, and heat it to boiling. Then having poured the hot solution of sodium carbonate into a capacious vessel, gradually pour in the hot solution of alum, with constant stirring, and add an equal volume of boiling distilled water. Let the precipitate subside, decant the clear liquid, and pour upon the precipitate two thousand cubic centimeters (2000 Cc.) [67 fl℥, 302 ♏] of hot distilled water. Again decant, transfer the precipitate to a strainer, and wash it with hot distilled water, until the washings produce not more than a faint cloudiness with barium chloride T.S. Then allow it to drain, dry it at a temperature not exceeding 40° C. (104° F.), and reduce it to a uniformly fine powder" (*U. S. P.*). This formula was essentially elaborated by Prof. J. U. Lloyd (see *New Remedies*, 1879, p. 237).

Description and Tests.—Aluminum hydrate is a light, amorphous powder, white, insoluble both in water and alcohol. It remains permanent in a dry atmosphere, and is without taste or odor. It readily and completely dissolves in sulphuric and hydrochloric acids, and in caustic potash and soda solutions, forming aluminates in the latter cases. It loses about 34.6 parts of water of hydration when heated to redness (*U. S. P.*). Aluminum hydrate has the property of forming insoluble compounds with coloring matters, as for example, madder or cochineal; hence the use of aluminum salts in the preparation of *lakes*, *e. g.*, carmine lake prepared from cochineal, and as mordants in dyeing fabrics. "A solution of 1 Gm. of aluminum hydrate in 20 Cc. of diluted hydrochloric acid should not at once assume a blue color on the addition of 1 drop of potassium ferrocyanide T.S. (limit of iron), and should not give more than a faint cloudiness with barium chloride T.S. (limit of sulphate). When dissolved in potassium or sodium hydrate T.S., it should yield no precipitate with hydrogen sulphide T.S. (absence of zinc or lead); and when boiled with 20 parts of water, and filtered, the filtrate should not leave more than a slight residue on evaporation (limit of alkali salts)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Absorbent, desiccant, and protective. Like the oxides of bismuth and zinc, it may be applied to *inflammations*, *burns*, and *excoriations*, and some of the diseases of the skin; it is likewise feebly astringent, and, like magnesium oxide, it may be used in acid states of the digestive organs resulting in *diarrhœa* and *dyspepsia*. Dose: 3 to 6 grains.

Aluminum and Its Compounds.—Symbol: Al. Atomic Weight: 27.4. ALUMINUM or ALUMINIUM. This is the metallic basis of the earth Alumina (*Aluminum oxide*, Al_2O_3) and is widely distributed in the earth's crust, forming the basic part of common clay (aluminum silicate) and various double silicates containing potassium, sodium, and other metals, as, for instance, the feldspar or garnet group. The metal, however, is not readily obtainable from its compounds except by somewhat laborious processes. It was first isolated, in 1827, by Wöhler, by melting together metallic potassium and chloride of aluminum under exclusion of the air. St. Clair-Deville, in 1854, was the first to isolate the metal in large quantities, obtaining it by the action of sodium upon sodium-aluminum-chloride, this salt having the advantage over aluminum chloride of being less hygroscopic. The metal obtained in this process was naturally very expensive. Bunsen, in 1854, was the first to prepare aluminum by the electrolysis of aluminum chloride, and in recent years the electrolytic separation of aluminum has become the dominant mode of manufacture, the details of which are mostly kept secret. Aluminum may now be counted among the common metals, costing at present only 45 cents a pound, while in 1879 one pound was as high as $20.

Aluminum is nearly as white as silver, malleable and ductile in the highest degree. When worked it appears to become harder, and its tenacity probably approaches that of iron. It may be hardened, and again softened, by annealing. Its specific gravity is about 2.600. It may be melted and run out into the air without being sensibly oxidized. It is a good conductor of heat, and, when pure, is completely unalterable in dry or moist air. If not contaminated with metallic sodium, of which it is liable to contain from 1 to 3 per cent (Moissan, *Drug. Circ.*, 1896), it will not become tarnished, and remains bright by the side of freshly cut zinc and tin, while the latter lose their brilliancy. It is not acted upon by hydrogen sulphide. Cold water has no action upon it, but boiling water oxidizes it slowly at 100° C. (212° F.). Nitric acid, either concentrated or diluted (Wöhler), and diluted sulphuric acid, when applied cold are also said to be without action upon it. With hydrochloric acid it evolves hydrogen, and forms chloride of aluminum. When heated to redness in hydrochloric acid gas, dry and volatile chloride of aluminum is produced. It is also soluble in alkaline liquids. Aluminum is highly sonorous.

Great claims have been made for this metal, many believing it destined to supersede iron as a construction material; also that it will replace the metals now in general use in the making of household utensils. These enthusiasts, however, overlook the fact that it is soluble in alkalies, forming aluminates, with the liberation of hydrogen. Were it to become a kitchen utensil, the constant use of soap and alkaline solutions in common use for the cleansing of such vessels would gradually dissolve the aluminum utensils. Again, if employed for cooking, the use of common salt (sodium chloride), which is a common necessity in nearly all culinary processes, would be apt to have a disintegrating effect upon the metal (see *e.g.*, data in Comey, *Dict. of Inorganic Solubilities*). It is, however, exceedingly useful in the manufacture of many ornamental articles, rivaling silver in its beauty. Its remarkable levity and freedom from oxidation renders it very valuable in the production of clocks, picture frames, etc. Some useful surgical and gynecological appliances are now made of this metal. Until recently, no method of soldering aluminum was known, but this now seems to have been accomplished. An alloy of zinc, tin, aluminum and phosphorus, is stated by Prof. J. Richards to make a good soldering material (*Drug. Circ.*, 1894). An alloy, of golden color, known as *aluminium bronze*, is composed of copper 90 parts, aluminum 10 parts. Aluminum as a base gives rise to the alums and other medicinal salts.

Aluminum oxide (Al_2O_3).—This compound exists in the mineral Corundum, a substance almost as hard as the diamond, forming crystals of the rhombohedric form, and varying considerably in color. It has several modifications or varieties which are transparent and used as precious stones, their color, as a rule, giving them their distinctive appellations. Thus, we have the *Sapphire* (blue), the *Ruby* (red, by the presence of chromium), *Oriental topaz* (yellow), *Oriental amethyst* (violet), *Oriental emerald* (green). The well-known polishing powder, *emery*, known also as *Lapis smiridis*, or *Lapis smyris*, or *Schmirgel*, is a coarser modification of corundum. Alumina, or oxide of aluminum, in grain doses of the 1x trituration, or 1 centesimal triturate, is indicated where the patient cannot pass the urine without great straining (Scudder, *Table of Spec. Ind.*).

Alumini Acetas, *Aluminum acetate* ($Al_2[C_2H_3O_2]_6+H_2O$).—This may be made by double decomposition of lead acetate and aluminum sulphate, when, by evaporation at a low heat, a styptic, gum-like product results, having acid properties. It may be prepared also by dissolving hydroxide of aluminum in acetic acid (cold). A solution (impure) is made by adding an aqueous solution of 5 parts of alum to an aqueous solution of 6 parts of lead acetate. This salt is a valuable antiseptic and antiputrefactive agent. In its general action it resembles alum. It removes the odor of foul secretions, as sweat, etc., and has been employed as an embalming liquid. *Furuncles* of the external auditory meatus have been aborted by it. It is a valuable deodorant in *gangrene*, besides preventing consequent *pyæmia*. Aluminum acetate is used as a mordant in dyeing.

Alumini Chloridi, *Aluminum chloride* (Al_2Cl_6).—This salt is prepared from a solution of hydroxide of aluminum in hydrochloric acid, which, when carefully evaporated, yields crystals containing 12 molecules of water. The anhydrous salt volatilizes; the hydrated salt decomposes when heated. It is dissolved by water and alcohol. A disinfecting solution is made by mixing solutions of alum (2 parts) and anhydrous calcium chloride (1 part), and filtering. On account of its lack of odor, it is especially useful in the sick room, as its deodorizing property is similar to that of acetate of aluminum, for which it may be substituted. Aluminum chloride finds a most useful application in organic synthesis (Friedel and Crafts).

Chloralum.—This deodorizer and disinfectant contains aluminum chloride to the extent of 15 per cent. Copper and arsenic, alum, alkaline sulphates, calcium chloride, and hydrochloric acid, are also ingredients. It has likewise been employed to check *hemorrhages*.

Alumini Nitras, *Aluminum nitrate* ($Al_2[NO_3]_6+18H_2O$).—This salt is deliquescent, and difficult to obtain in crystalline form. Twenty parts of nitric acid are employed to dissolve such an amount of aluminum hydroxide as will be yielded by 33 parts of potash alum, or 31.5 parts of ammonia alum. This salt has been used in solution as an application to itching surfaces, as *pruritis vulvæ*.

Alumini Aceto-Tartras, *Aluminum aceto-tartrate*, *Aluminum acetico-tartaricum*. — Take basic acetate of aluminum, 5 parts, tartaric acid, 2 parts, water q. s. Solve and evaporate to dryness. The salt thus formed is in almost colorless, shining masses, amorphous, soluble in water, insoluble in alcohol, has an astringent, sour taste, and a weak, vinegar-like odor. An aqueous solution of it has been employed as an astringent and antiseptic. Its action is similar to that of acetate of aluminum. It is nonpoisonous, and has been employed in *ozæna* and other offensive conditions. The *aceto-glycerinate of aluminum* has similar medical properties.

Ultramarine.—An Asiatic mineral known as *Lapis lazuli* (*lazulite*), formerly furnished this pigment. Lazulite is a compound of aluminum and sodium silicate with sodium polysulphide. At the present time it is artificially produced by the ton, the color of the artificial product exceeding in beauty even that prepared from the mineral. Several colors are prepared, and known as *white*, *green*, *violet*, *red*, and *blue ultramarines*. Ultramarine is made by heating together a mixture of white clay with sodium sulphate and carbonaceous material in crucibles; a variety richer in silica is obtained by heating clay with finely ground quartz sand, soda, sulphur, and colophony in muffled furnaces; a blue product thereby at once results. The composition of the artificial product is not definitely known. The blue variety is largely employed in neutralizing the yellowness of paper, sugar, starch, and other materials. Ultramarine was first observed, in 1814, by Tessaert, in the black-ash furnaces of glass works, and found identical with lapis lazuli by Vauquelin. It was first prepared artificially, simultaneously by Guimet and by Gmelin, in 1824, the investigation being carried on at the instance of the French government, which offered a prize therefor. Ultramarine is easily distinguished from any other blue pigment by the fact that it evolves hydrogen sulphide when treated with acids, becomes discolored and deposits sulphur.

BOLUS, *Bole*.—This term has been applied to various argillaceous earths in times past. They are substances composed chiefly of aluminum silicate. All of them are unctuous to the touch, will adhere to the tongue, break with a shell-like fracture, and are soft enough to be easily scraped off with any cutting instrument. Though not soluble, they gradually form, with water, a paste-like mass. They have received different names, and are distinguishable by their colors, thus:

Bolus alba, or *Terra alba*, *Argilla*, a white form, containing, in addition to aluminum silicate, magnesium oxide in small amount, as well as a very little iron.

Bolus Armena, *Armenian bole*, *Bolus rubra*, *Argilla ferruginea*. Brownish-red in color, caused by the quite large amount of ferric oxide present. It received its name from Armenia, the country in which it was first produced. It is now found in various European localities. At one time this variety, and the one following, were highly prized under the name *terræ sigillatæ*, so called from the fact that circular cakes of them could be impressed with a seal.

Terra lemnia, *Lemnian bole*. Almost identical with Armenian bole, but containing less ferric oxide, being yellow in color.

Bolus Veneta, or *Venetian red*, is an ochery body of a dull-red color, employed in painting.

Creta rubra, *Red chalk*, *Reddle*, *Rubrica fabrilis*. This occupied a place between *red ochre* and *bole*. It is of a deep-red color, is firm and dense in texture, will soil the hands, and leave upon paper a bright-red mark when drawn over it. Its red color is due to iron. It is sometimes made into crayons and used to draw upon wood, stone, and other hard substances. All of the foregoing have been employed medicinally, being prepared by pulverization and elutriation. Bole was employed by the ancient Romans and Greeks, but is very little used in medicine at the present time, though occasionally employed in Europe. It is astringent and absorbent. The dose is from 5 to 10 grains. Internally it has been used in *relaxed conditions of the alimentary tract*, in *hemorrhagic states*, and *pulmonary affections*. It was used locally in many conditions requiring an absorbent astringent. Armenian bole is sometimes used to color dentifrices.

TERRA TRIPOLITANA, *Tripoli*.—A whitish, pale-straw or yellowish-colored earth, sometimes even brownish or reddish, presenting a clayey aspect, though differing from clay in not forming a paste when rubbed with water, and in having rough and hard particles. It is usually easily broken, and will often adhere to the tongue. It is employed in scouring and polishing metallic surfaces. A variety known as Venetian Tripoli is said to come from Corfu. Tripoli is sometimes artificially prepared by calcining argillites.

SIENNA, *Terra di sienna*.—A smooth, glossy, clayey mineral, light in weight but very compact and fine in texture, having a yellow-brown color tinged with orange. This is *Raw sienna*. When burned it is known as *Burnt sienna*, and has a red-brown color. Both varieties are used as pigments, the best grades coming from Italy.

KAOLIN, *Fullers' earth*, *Porcelain clay*. A white clay in the form of a powder, which appears unctuous when wet. It is nearly pure hydrated aluminum silicate, generally answering to the formula $Al_2(SiO_3)_3+Al_2O(OH)_4$, and is formed by the weathering of feldspar minerals.

PUMICE STONE, *Pumey*, *Pumex*.—A light, porous, stone-like substance, most of which comes from near Lipari. As it is found near volcanoes, it is regarded as a product of volcanic eruption, the spongy texture being produced by the presence of watery vapor in the hot, fluid lava. Pumice stone is of great value in the arts, being employed either whole or in powder, as a polishing substance for metals, glass, stone, and particularly in giving a smooth surface to painted wood-work, as to carriage bodies, etc.

ALUMINI SULPHAS (U. S. P.)—ALUMINUM SULPHATE.

FORMULA: $Al_2(SO_4)_3$. MOLECULAR WEIGHT: 342.06.

Crystallized, $Al_2(SO_4)_3.16H_2O$. Molecular weight, 628.9.

Preparation.—This salt is prepared on a large scale from China clay, by roasting the clay and then digesting it in diluted sulphuric acid, the solution being permitted to stand until clear. It is then decanted from the insoluble matter (silica and undecomposed alumina), and evaporated until it thickens upon cooling. As thus prepared, it is often known as *concentrated alum* (*alum cake*), and is used mainly as a mordant, and also to give weight to paper. The composition of anhydrous aluminum sulphate is represented by $Al_2(SO_4)_3$. The hydrated salt, $Al_2(SO_4)_3+16H_2O$, was official in the *United States Pharmacopœia* (1870); the former process of which forms precipitated trihydrate of aluminum (AlH_3O_3, or $Al_2[OH]_6$), by the decomposition of sulphate of aluminum and ammonium, by means of sodium carbonate; sulphates of sodium and ammonium remaining in solution, and carbonic acid gas being evolved. It is intended that the precipitated aluminum hydrate be freed from soluble sulphates by washing, then united with sulphuric acid, and the solution evaporated to dryness, whereby crystallized aluminum sulphate, $Al_2(SO_4)_3+16H_2O$, is obtained. Practically, it will be found that the water in which the salts (carbonate of sodium and the alum) are dissolved by the *U. S. P.* is insufficient, inasmuch as the solution of the alum may be troublesome to make, and when obtained, the two solutions are so concentrated that the hydrate is deposited in lumps, difficult, if not impossible, to free from contaminating sulphates by the subsequent process intended for washing.

The formula of the *U. S. P.* (1870) has been referred to here because we think the process an objectionable one, and would present the following as an improvement upon it (see *New Remedies*, August, 1879, p. 237):

Dissolve 4 troy ounces of alum, and the same amount of carbonate of sodium, each separately, in 4 pints of hot distilled water; pour the alum solution, in a small stream, with constant stirring, into the soda solution in a capacious porcelain dish, and bring the mixture to a fair boil. Then cool and pour the mixture upon a muslin strainer; when drained, return the precipitate to the dish, and mix thoroughly with a gallon of water, then strain, as before. Repeat the operation; then almost dissolve the gelatinous precipitate by means of diluted sulphuric acid, and filter the solution; evaporate it upon a water-bath, with stirring, until a dry salt remains. In case there is an excess of acid, it will be impossible to dry the salt; therefore we advise the use of not more than 1 troy ounce of sulphuric acid, thus insuring complete saturation. The excess of aluminum hydrate will remain upon the filter.

Description.—"A white, crystalline powder, without odor, having a sweetish, and afterward astringent taste, and permanent in the air. Soluble in 1.2 parts of water, at 15° C. (59° F.), and much more freely in boiling water, but insoluble in alcohol. When gradually heated to about 200° C. (392° F.), it loses its water of crystallization (45.7 per cent of its weight). The salt has an acid reaction on litmus paper"—(*U. S. P.*).

Sulphate of aluminum prepared as above, may contain traces of the sulphates of sodium and ammonium, which, however, is not a serious objection, unless in larger amount than is possible with the process we have given. It crystallizes with difficulty, forming thin 6-sided crystals. According to Berzelius, it is soluble in 2 parts of cold water. It melts on heating, in its water of crystallization, and then swells, like alum, forming the anhydrous sulphate, $Al_2(SO_4)_3$. At a red heat, it decomposes, the residue being alumina.

"The aqueous solution of the salt yields, with barium chloride T.S., a white precipitate insoluble in hydrochloric acid; and with potassium or sodium hydrate T.S., a white, gelatinous precipitate which is soluble in an excess of the alkali, but is again separated on the addition of a sufficient amount of the ammonium chloride T.S. A filtered, 10 per cent aqueous solution of the salt should not be affected by hydrogen sulphide T.S. (absence of copper, lead, or zinc), and should not become more than faintly opalescent within five minutes after the addition of an equal volume of decinormal sodium hyposulphite V.S. (limit of free acid). 20 Cc. of a 5 per cent aqueous solution of the salt should not at once assume a blue color on the addition of 5 drops of potassium ferrocyanide T.S. (limit of iron). If 1 Gm. of the salt be gently heated with 5 Cc. of potassium or sodium hydrate T.S., the liquid should not evolve the odor of ammonia"—(*U. S. P.*).

Action and Medical Uses.—Sulphate of aluminum is employed as a local application in cases in which a stimulating, astringent, or antiseptic action is required. From 4 to 6 pounds of the salt dissolved in 1 gallon of water, and the solution injected into the cadaver, in the usual way, will preserve it in the dissecting room for from 18 days to 2 or 3 months, according to the temperature of the weather (Gannal). A solution consisting of from 75 to 240 grains of this salt in 3 fluid ounces of water, has been found exceedingly useful as a topical application to *old ulcers*, and in *leucorrhœa* with offensive discharge. A saturated solution, and more especially when in combination with zinc oxide, has been employed as a stimulant or gentle caustic in *tonsillar enlargements, polypus of the nose, affections of the uterine cervix, mother's mark, obstinate ulcers, chronic catarrh*, and in other chronic diseased conditions of mucous tissues; it may be applied every day in form of spray or with a camel's hair pencil. A "benzoinated solution of aluminum," diluted with from 25 to 64 times its weight of water, forms an excellent application in *chronic nasal discharges*, in *ulcerated conditions of the os uteri*, as well as in *offensive vaginal discharges;* it may be used by injection, or in the form of spray. This benzoinated solution is prepared by dissolving 4 ounces of aluminum sulphate in 8 fluid ounces of water, then adding recently formed gelatinous alumina to saturation, and finally adding 8 drachms of coarsely powdered benzoin—the best article of benzoin, that in the form of whitish tears, being used for this purpose. This solution is kept at a temperature of from 64.4° to 66.7° C. (148° to 152° F.), for 6 or 7 hours, being stirred from time to time until, when filtered, it has attained the specific gravity, 1.260. It is then set aside in a cool place for 6 or 7 days, until alum crystals are precipitated, and the solution has acquired a balsamic odor and taste, with astringency.

AMARANTHUS.—AMARANTH.

The leaves of the *Amaranthus hypochondriacus*, Linné.

Nat. Ord.—Amaranthaceæ.

COMMON NAMES: *Amaranth, Prince's feather, Lovely bleeding, Red cockscomb.*

Botanical Source and History.—An annual herb, with a stout, upright stem, growing from 3 to 4 feet high, bearing oblong, lanceolate, mucronate, green leaves, having either a red-purple spot, or tinged with purple. The flowers, which are bright-red, are compactly clustered on erect, compound racemes. The whole plant is dark-red, or reddish-purple, with long, plume-like clusters. This plant is a native of the Middle States, and is cultivated as an ornamental plant in gardens. It bears deep, bright-red flowers in August. The leaves, which are the parts used, are also red, and yield their virtues to water.

Action and Medical Uses.—Amaranth is astringent. The decoction drunk freely is highly recommended in severe *menorrhagia*, and has also been found beneficial in *diarrhœa, dysentery*, and *hemorrhage from the bowels*. It has likewise been used as a local application in *ulceration of the mouth and throat*, in *leucorrhœa*, and as a wash to *foul, indolent ulcers*. It is scarcely used at the present day.

Related Species.—*Amaranthus melancholicus ruber* contains 16 and *Amaranthus atropurpureus* nearly 23 per cent of potassium nitrate (Boutin). *Amaranthus caudatus* contains oxalic acid.

AMBRA GRISEA.—AMBERGRIS.

SYNONYM: *Ambra cinerea.*

Source.—An odorous, fatty material, believed to be a morbid production of the *Physeter macrocephalus*, Linné, or *Sperm whale.* It is found in the intestines of the whale, where it is thought to be produced, and also excreted and floating in large masses upon the waters of the sea. A single whale has yielded over 700 pounds of ambergris (*Amer. Jour. Pharm.*, 1859). The manner of production of ambergris is not definitely known, though it is supposed to be derived from the fatty matter of certain cephalopods consumed as food by the whale.

Description.—Ambergris occurs in irregular, wax-like masses, of a grayish or grayish-brown color, streaked or mottled, and opaque. Its density is less than that of water; it becomes soft and waxy by the warmth of the hand, but when cold is friable. It is also inflammable, and when heated is almost completely volatilized. Its odor is peculiar and fragrant. Ambergris has little or no taste. It is subject to adulteration, but may be distinguished by its physical characters.

Chemical Composition.—The chief constituent (80 to 85 per cent) of ambergris is *ambrein* (Pelletier and Caventou), a fatty body bearing some resemblance to cholesterin. It may be obtained in shining, white, needle-like crystals, odorless and tasteless. According to an analysis by John, in 1818, it also contains coloring matter, balsamic substances, sodium chloride, and benzoic acid.

Medical and Other Uses.—This substance has been employed as a stimulant to the circulatory and nervous systems. On account of its supposed selective affinity for the generative apparatus of the female, it has been given in *hysterical disorders* of a spasmodic character. Musk, castor, and like animal drugs, as well as valerian, have been frequently given in conjunction with it. It has likewise been employed in *low grades of fevers.* The dose is from 5 to 20 grains in substance, or in solution in ether. It is more generally used in the preparation of perfumes. Ambergris was formerly employed in cookery.

Tinctura Ambræ.—Finely triturate with well-washed sand 10 parts of ambergris; then macerate the powder in 100 parts of alcohol (80 per cent). This tincture is often employed in fixing the odors of delicate, volatile perfumes.

AMBROSIA TRIFIDA.—TALL AMBROSIA.

The leaves of the *Ambrosia trifida*, Linné.

Nat. Ord.—Compositæ.

Common Names: *Tall ambrosia, Great ragweed, Horseweed, Horse cane, Richweed, Wild hemp, Bitterweed.*

Botanical Source.—Ambrosia trifida is a rough, hairy, herbaceous, annual plant, with an erect, branching, furrowed stem, from 5 to 10 feet in height. Its leaves are opposite, from 4 to 7 inches broad, scabrous and hairy, with three large, deep lobes which are oval, lanceolate, acuminate, and closely serrated; the lower leaves are often 5-lobed. The petioles are narrowly winged and ciliate; racemes often paniculate. The flowers are mean and obscure, in long, leafless spikes, axillary and terminal. The fruit (fertile involucre) is turbinate-obovoid, with a short, conical-pointed apex, 6-ribbed, the ribs terminating in as many cristate tubercles. It has a variety called *Ambrosia trifida*, var. *integrifolia.*

History.—This plant grows in low grounds and along streams, from Canada to Georgia, and west to Louisiana and Arkansas, bearing greenish-yellow flowers in August. It is much in use among farmers, for the "slabbers" in horses, effecting a cure in a few hours. It has a spicy, pleasant, aromatic taste, slightly resembling ginger, and imparts its properties to water. According to Rafinesque, the aborigines used it to make a sort of hemp and ropes.

Action, Medical Uses, and Dosage.—This plant is slightly stimulant, astringent, hemostatic, and antiseptic. Useful in decoction as an injection in *leucorrhœa, prolapsus uteri, chronic gonorrhœa*, and *gleet;* also valuable as a collyrium, in *ophthalmia*, and as a wash or gargle—with its internal use also—in *nursing sore mouth.* It will be found an excellent application to mercurial, and all other *ulcers* of a fetid or gangrenous character. As a remedy for *mercurial salivation*, used every half hour as a wash, it is said to be prompt and efficacious. Internally, the decoction is useful in *fevers*, attended with a disposition to *putrescency, diarrhœa*, and *dysentery.* It has been successfully employed in *bleeding from the nose*, and other *hemorrhagic discharges*, where the flow is small in amount. It has also been employed for the relief of *after-pains*, for *hysteria* and other *nervous disorders.* Dose of the decoction (tops ℥ss, aqua Oj) from 1 to 2 fluid ounces.

Related Species.—*Ambrosia artemisiæfolia*, Linné (*Ambrosia elatior*), *Roman wormwood*, or *Ragweed*, has a slender stem rising from 1 to 3 feet high, much branched, and pubescent when young; leaves opposite, the upper alternate, twice pinnatifid, smoothish above, paler or hoary beneath; barren flowers small, green, in terminal racemes, or spikes loosely panicled; fertile ones sessile about the axis of the upper leaves; fruit obovoid, or globular, pointed, armed with about 6 short acute teeth or spines (W.—G.). It is sometimes called "hog-weed," as but few animals excepting the hog will eat it. Cows occasionally partake of it, and it imparts to their milk a bitter taste which remains in butter made from the tainted cream. When carelessly gathered with wheat it also imparts to the flour of that cereal a bitter flavor, rendering it unfit for bread-making. Schimmel & Co., in 1894, isolated by distillation from the blooming plant, an essential oil, of deep-green color, and specific gravity 0.870. It has an aromatic, not unpleasant odor. *Ambrosia trifida*, subjected to the same process, did not yield any volatile oil. Ragweed is highly recommended as a fomentation in recent *inflammation* from *wounds* or injuries of any kind. Made into a salve by bruising the green leaves, and simmering them in spirits and cream, it is very useful in *hemorrhoidal tumors*, and some forms of *ulcer.* It may be used as a tonic after *intermittents*, and to alleviate *mucous fluxes.* Dose: Specific ambrosia artemisiæfolia, 1 to 10 drops every 1 to 4 hours. Infusion (tops ℥ss, to aqua Oj), 1 to 2 fluid ounces. It is very common in all our fields, and would probably prove fully as efficacious, if not more so, than *A. trifida.*

AMMONIA.–AMMONIA GAS.

FORMULA: NH_3. MOLECULAR WEIGHT: 17.01.

Source, History, and Preparation.—Ammonia was unknown to the ancients; it was discovered in a state of solution by Black, in 1756, and in the pure gaseous condition by Priestley, in 1774, who produced it by heating a mixture of lime and sal ammoniac, and collecting the ammonia over mercury. Priestley named it "*volatile air.*" To the earlier chemists it was known as *volatile alkali*, in contradistinction to *fixed alkali* (caustic potash), and to *marine alkali* (caustic soda). The alchemists were acquainted with a volatile alkali found in the urine, from which sal ammoniac was obtained by Geber. Ammonia exists abundantly as the product of the decomposition of vegetable and animal matter, chiefly the latter. When hoofs, horns, bones, and other animal substances are subjected to dry distillation, ammonium compounds are formed. The ammonia thus obtained has the name, *spirits of hartshorn.* The atmosphere contains a small amount of ammonium in combination with carbonic acid gas as carbonate. It has likewise been found in snow. In rain water it has been observed in combination with nitric and nitrous acids. The soil contains it, and it is especially abundant in natural beds of ammonium chloride, resulting from the decomposition of nitrogenous bodies. Most plants contain ammonium in combination. The principal source of gaseous ammonia at the present day is the *ammoniacal liquor* derived from the manufacture of illuminating gas. From this by-product it is obtained on a large scale by distilling with milk of lime, and neutralizing the distillate with hydrochloric acid; or the ammonia gas resulting from the distillation of gas liquor is allowed to pass into diluted sulphuric acid, from which it is crystallized as sulphate of ammonium. This salt is purified, and in turn is made to yield ammonia, by decomposition with the caustic alkalies. It may be obtained from any of the ammonium salts by heating them with potassic, sodic, or calcic hydroxides. A common method is to heat sal ammoniac (ammonium chloride) with lime: $2(NH_4Cl)+Ca(OH)_2=CaCl_2+2H_2O+2NH_3$. Ammonia may also be prepared on a commercial scale by heating together in a retort (glass or iron), sulphate of ammonium and calcium hydroxide. When nitrous or nitric acid is acted upon by nascent hydrogen, ammonia results (see *Aqua Ammoniæ*).

Description.—Ammonia is a volatile, colorless gas, having a characteristic, pungent odor, and imparting an acrid, alkaline taste. It is irrespirable, causing spasm of the glottis when an attempt is made to inhale it. Under ordinary atmospheric temperatures and pressures it is a permanent gas. At —40° C. (—40° F.), it is condensed to a colorless liquid, or at 15° C. (59° F.), under a pressure of 7 atmospheres, it may also be reduced to a very mobile, colorless liquid, lighter than water. At —75° C. (—103° F.), it freezes, forming white crystals. Its specific gravity is 0.59+. When ammonia is rendered liquid by pressure and then allowed to evaporate spontaneously in suitable vessels, an absorption of heat, *i.e.*, an excessive cold, is produced during evaporation. An important technical application is made of this principle in the manufacture of artificial ice. Ammonia is strongly alkaline, turning red litmus paper blue, and turmeric paper brown. It is very soluble in water, the latter dissolving about 700 times its volume of ammonia gas, forming hydroxide of ammonium (NH_4OH). Alcohol absorbs it. With acids it readily combines to form crystallizable salts, which, when heated, are either sublimed or decomposed. In contact with gaseous acids, *e. g.*, hydrochloric acid, it combines with them to form a dense smoke of white salts. It enters into the formation of many medicinal salts, and in solutions of definite strengths, it forms *Aqua Ammoniæ* and *Aqua Ammoniæ Fortior.* It burns in pure oxygen with the formation of water, nitric acid, and the liberation of free nitrogen. Animal structures are irritated and inflamed by this gas. Ammonia gas may be easily recognized by its characteristic odor, and by the black coloration it imparts to a strip of bibulous paper saturated with a solution of mercurous nitrate, a compound, $Hg_2NH_2.NO_3$, being formed. An alcoholic solution of ammonia (10 per cent) forms the official *Spirit of Ammonia* (see *Spiritus Ammoniæ*).

Action and Medical Uses.—(See *Aqua Ammoniæ*).

AMMONIACUM (U. S. P.)—AMMONIAC.

"A gum resin obtained from *Dorema Ammoniacum*, Don"—(*U. S. P.*).
Nat. Ord.—Umbelliferæ.
COMMON NAMES: *Gum ammoniac, Gummi-resina ammoniacum.*

Botanical Source.—The Dorema Ammoniacum is a glaucous green plant resembling opopanax. Its root is perennial and large, from which arise smooth stems, 8 or 10 feet high, and over 1 inch in diameter at the base, having petiolate, somewhat bi-pinnate leaves, about 2 feet long; the pinnæ are in 3 pairs, the leaflets are inciso-pinnatifid, with oblong, mucronulate, entire, or straightly-lobed segments, from 1 to 5 inches long, and $\frac{1}{2}$ inch to 2 inches broad. The petiole is downy, very large, and sheathing at the base. The umbels are proliferous and racemose, being composed of partial, globose umbels, on short stalks, often arranged in a spiked manner. The flowers are white, sessile, and immersed in wool. The fruit, which is elliptical and compressed, is also buried in wool, and surrounded by a broad, flat edge (L).

History.—From a want of correct knowledge of the plant furnishing this gum-resin, it was formerly considered a *Ferula*, but specimens of the Persian plant having been investigated by Don, he ascertained that, although it was somewhat related to this genus, yet it differed from it in several characters; he therefore gave to it its present name. The plant grows on arid, exposed situations in several parts of Persia, and in the course of the summer it is replete with a lacteous, gelatinous juice, which is readily obtained. It prefers a soil abounding in silica. Mr. Jackson says: "It is remarkable that neither bird nor beast is seen where this plant grows, the vulture only excepted. It is, however, attacked by a beetle, having a long horn proceeding from its nose, with which it perforates the plant and makes the incisions whence the gum oozes out." Colonel Johnson states that "in the month of May, while the plant is soft, an insect of the beetle kind begins to puncture the stem in every direction with his proboscis," etc. Captain Hart gives a similar account. But Fontanier asserts that it flows naturally, and is gathered in June. It is still supposed, however, to be sometimes furnished by other and dissimilar plants of Asiatic as well as African growth. It is asserted that in some places it is collected after the manner of obtaining asafœtida. Around the plant, imbedded in the soil, are often formed tears of the gum which have either exuded into the ground from the root, or have dropped from the punctured stems. From the fibrous root-crown an inferior quality of gum is made to exude, which is dark in color. Gum ammoniac is mostly gathered by the peasantry in July. *Cake ammoniac* consists of tears of the gum admixed with the inferior brown exudation from the stem-base.

Description.—Gum ammoniac is not a gum proper, but a gum-resin; it is met with in tears and in lump. The tears vary in size from that of a small pea to that of a walnut. The lump ammoniac varies in appearance according to its quality. The best kind is composed chiefly of tears agglutinated together, though foreign impurities are frequently present. Ammoniac does not melt, but softens by heat, even the warmth of the hand; at a red heat it burns with a white flame. It may be partly dissolved by water, forming a white emulsion, which, upon standing, precipitates a resinous portion, leaving the supernatant liquid clear. Alcohol dissolves more than one-half, the remainder being a resin, insoluble in this liquor; and the soluble white resin is precipitated by the addition of water to the alcoholic solution. Ether dissolves resin and volatile oil, leaving the gum. Vinegar forms a smooth, uniform emulsion with it, but does not dissolve it. Mr. Hatchett found it soluble in alkalies. The *U. S. Pharmacopœia* thus describes ammoniacum: "In roundish tears, from 2 to 6 Mm. ($\frac{1}{12}$ to $\frac{1}{4}$ inch) or more in diameter; externally pale yellowish-brown, internally milk-white, brittle when cold, and breaking with a flat, conchoidal, and waxy fracture; or the tears are superficially united into irregular masses without any intervening, dark-colored substance. It has a peculiar odor, and a bitter, acrid, and nauseous taste. When triturated with water, it readily yields a milk-white emulsion"—(*U. S. P.*).

Chemical Composition.—Ammoniac has been analyzed by Braconnot, Bucholz, Hagen, Hirschsohn, Plugge, and others, and appears to consist of a large proportion of resin, with gum, bassorin, volatile oil, and water. The *resin* of ammoniac, amounting to 70 per cent, or less, is reddish or yellow, transparent, tasteless, but having the odor of the gum-resin; is brittle, softens in the hand, melts at 54.4° C. (130° F.), and is soluble in alcohol, and in excess of carbon disulphide. Ether separates it into an insoluble resin, and a resin soluble in sulphuric acid, and fixed and volatile oils. Alkalies form a cloudy solution. Nitric acid converts it into a yellow bitter matter, soluble in hot alcohol and water, and which will dye silk a fine yellow color, without being affected by chlorine. The *gum* is reddish-yellow, transparent, brittle, somewhat bitter, soluble in water, from which it is precipitated by subacetate of lead, and is converted into mucic, malic, oxalic, etc., acids, by the action of nitric acid. The *oil*, which may be obtained by distillation of the gum-resin with water, is transparent, colorless, and lighter than water. It is yielded to the extent of $\frac{1}{4}$ to $\frac{1}{3}$ per cent, has a specific gravity of 0.891 at 15° C. (59° F.), and boils between 250° and 290° C. (482° and 554° F.), (Schimmel & Co., *Semi-Annual Report*, Oct., 1893). The oil has dextrogyrate properties (*Pharmacographia*). Hlasiwetz and Barth (1864), obtained oxalic acid, resorcin, and a fatty acid of a volatile nature by fusing the gum-resin with caustic potash. It differs chemically from most of the allied gum-resins, in not yielding *umbelliferon* upon dry distillation. Neither does the drug contain sulphur.

Action, Medical Uses, and Dosage.—Gum ammoniac possesses stimulant, antispasmodic, and expectorant properties, and is said to purge in inordinate doses, as well as to produce vomiting, colic, and cutaneous eruptions. It has been found especially useful in chronic affections of the respiratory organs, especially among the aged, or those in whom the expectoration is scanty, as in *cough*, *asthma*, etc., and has likewise been found advantageous in *profuse mucous discharges*, the result of weakness of the parts involved, as in *bronchitis* or *laryngitis*, *catarrh*, *leucorrhœa*, etc. It has also been advised in *hysteria*, but is inferior to some other of the fetid gum-resins, as asafœtida. Ammoniacum may be of service in small doses, in the *headache* resulting from disease of the frontal sinuses, in *affections of the optic nerve*, in *catarrhal affections of the throat*, *nasal passages*, *eyes*, *ears* and *stomach*, *mucous diarrhœa*, and in pains in the limbs accompanying disease of more or less of the mucous tissues generally. Applied externally in the form of plaster, it irritates the skin, frequently producing a papular eruption; and has been employed beneficially in this way, as a resolvent, to *indolent buboes*, *white swelling*, *tumor of the joints*, *chronic glandular enlargement*, and other *indolent swellings*. The dose is from 1 to 30 grains, in pill or in emulsion.

Related Species and Gum-Resins.—*Dorema Aucheri*, Boissier. Western Persia. This species is thought to furnish a portion of the gum ammoniac of commerce. The plant is known in the Kurdish vernacular as *Zuh*.

Dorema robustum, Loftus. Western Persia. Yields a gum unlike that from *Dorema Ammoniacum*, Don (*Pharmacographia*).

Ferula tingitana, Linné. North Africa and extreme West Asia. It is known in Morocco as *Kelth*, and its gum by the name *Fasay*. The latter is generally known, however, as *African ammoniac*. The gum differs from true gum ammoniac in having a comparatively weak odor, and in yielding *umbelliferon* (Hirschsohn). A peculiar acid, having the formula $C_{10}H_{10}O_6$, not present in the true gum, was obtained by fusing the Moroccan gum with caustic potash (Goldschmiedt). As with the true gum, resorcin was obtained by fusion with caustic potash. African ammoniacum occurs in dense, large, dark masses, formed by the agglutination of whitish, fawn-colored, or light-greenish tears, some specimens containing a considerable amount of foreign admixtures. It has a persistent, faintly-acrid taste, and is principally used by the Mahometans as incense.

Opopanax Chironium, Koch. Southern Europe, along the Mediterranean Sea. This plant is supposed to be the source of a rare and costly gum-resin known as OPOPANAX (see *Opopanax*).

AMMONII BENZOAS (U. S. P.)—AMMONIUM BENZOATE.

FORMULA: $NH_4C_7H_5O_2$. MOLECULAR WEIGHT, 138.72.

SYNONYMS: *Ammoniæ benzoas*, *Ammonium benzoicum*.

Preparation.—Mix equal amounts of ammonia water and distilled water, and dissolve in the mixture enough benzoic acid to bring to slight acid reaction. Then make the solution slightly alkaline by the addition of ammonia water and evaporate to dryness, occasionally adding a few drops of ammonia water. Two parts by weight of benzoic acid require about 3½ parts of ammonia water. Benzoate of ammonium can easily be crystallized, if the operator prefers, instead of evaporating the solution to dryness.

Description.—The following description is that of the official salt: "Thin, white, 4-sided, laminar crystals, odorless, or having a slight odor of benzoic acid, a saline, bitter, afterward slightly acrid taste, and gradually losing ammonia on exposure to the air. Soluble at 15° C. (59° F.). in 5 parts of water, and in 28 parts of alcohol; in 1.2 parts of boiling water, and in 7.6 parts of boiling alcohol. When strongly heated, the salt melts, emits vapors having the odor of ammonia and benzoic acid, and is finally completely dissipated. The salt is neutral, or has a very slightly acid reaction upon litmus paper. A saturated, aqueous solution of the salt affords, with ferric chloride T.S., a flesh-colored precipitate, and when it is gently heated with potassium or sodium hydrate T.S., the odor of ammonia is evolved. If diluted nitric acid be added to a 10 per cent aqueous solution of the salt, a precipitate of benzoic acid is produced, which, when thoroughly washed, should respond to the tests of purity mentioned under *Acidum Benzoicum*, and the filtrate from this precipitate should not be affected by barium chloride T.S. (absence of sulphate), or by silver nitrate T.S. (absence of chloride)"—(*U. S. P.*). This salt must be kept in well-stoppered vials.

Action, Medical Uses, and Dosage.—This salt is a mild diuretic, somewhat stimulant, forming hippuric acid with decrease of urea in the urine. It has been employed as a diuretic in cases of *deficient activity of the renal organs*, in *chronic irritation of the urinary mucous membrane*, in *phosphatic urinary sediments*, of which it tends to aid the solution, and in *gout*. Its uses are much the same as those of benzoic acid. It should be employed as indicated below. The dose is from 10 to 60 grains, in water, 2 or 3 times a day.

Specific Indications and Uses.—Scanty and pungent, dark-red urine, with thick deposits; urinary incontinence of the aged, with cystic irritation or subacute inflammation, and headache, drowsiness, pain in loins and limbs. A 2x trituration in doses of 2 or 3 grains is recommended for the urinary troubles of the aged.

AMMONII BROMIDUM (U. S. P.)—AMMONIUM BROMIDE.

FORMULA: NH_4Br. MOLECULAR WEIGHT: 97.77.

Preparation.—Add a solution of carbonate of ammonium to a solution of bromide of iron, stirring constantly as long as a precipitate results, and until the ammonium carbonate is in slight excess. Filter the liquid from the magma and wash the precipitate well with water, adding the washings to the original filtrate. Lastly, evaporate the mixed liquids to dryness. Bromide of ammonium may also be made by saturating hydrobromic acid with ammonia water and evaporating the product to dryness.

Description and Tests.—"Colorless, transparent, prismatic crystals, or a white, crystalline powder, odorless, of a pungent, saline taste, and permanent in the air. Soluble at 15° C. (59 F.), in 1.5 parts of water, and in 30 parts of alcohol; in 0.7 part of boiling water, and in 15 parts of boiling alcohol. When heated, the salt volatilizes completely without melting. The aqueous solution of the salt has a slightly acid reaction upon litmus paper. When the aqueous solution is gently heated with potassium or sodium hydrate T.S., the odor of ammonia is evolved. If to another portion of the solution a little chloroform be added, and subsequently a few drops of chlorine water, and the whole agitated, the chloroform will acquire a yellowish or yellowish-brown color without a violet tint. If a few drops of diluted sulphuric acid be brought in contact with a little of the powdered salt on a porcelain plate, the salt should not at once assume a yellowish color (absence of bromate). A 10 per cent aqueous solution should not be affected by hydrogen sulphide T.S. (absence of metals), nor by barium chloride T.S. (absence of sulphate). 20 Cc. of a 5 per cent aqueous solution of the salt should not at once assume a blue color on the addition of 5 drops of potassium ferrocyanide T.S. (limit of iron). If 3 Gm. of the salt, dried at 100° C. (212° F.), be dissolved in water to the measure of 100 Cc., 10 Cc. of this solution, after the addition of a few drops of potassium chromate T.S., should require not more than 30.9 Cc. of decinormal silver nitrate V.S. to produce a permanent red coloration (absence of more than 1 per cent of ammonium chloride)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—According to Dr. Gibb, this salt is tonic, sedative, or antispasmodic, according to the quantity given, and the mode of administration. In large doses, frequently repeated, or given at intervals, it influences the entire mucous tract, affects all the special senses, and produces impaired sensibility of the various mucous outlets. In very large doses it produces poisonous effects analogous to those caused by similar doses of bromide of potassium. Though more irritant to the stomach, it is less depressing to the heart than the latter salt. It is more certain and reliable in small doses, causing no diarrhœa nor diuresis, while its special properties are exerted sooner, and with less inconvenience. In small doses, more or less continued, it acts as a tonic and absorbent, and exerts its peculiar properties on the skin and mucous membrane; it possesses a soothing influence on the mucous membrane, and according to the strength and mode of its application, so does it diminish the sensibility; it improves the intellectual powers, increases the bodily capacity, and promotes healthy functions; when continued with a well regulated diet, it diminishes the weight of the body, causing absorption of fat in the economy, and arresting atheromatous changes. It has been found beneficial in *corpulency*, *cutaneous diseases*, *glandular and other enlargements*, *scrofulous affections*, *scrofulous ophthalmia*, and *epilepsy* due to certain causes. Bromide of ammonium is serviceable in *pertussis*, in doses of 1 grain for each year of the patient's age, repeating the dose several times a day. The cases in which it is valuable are those in which the cough is associated with epileptiform movements of the extremities, or where the movements of the chest are more or less convulsive. It is also employed in cases of *nervous prostration*, from sexual excesses or masturbation, accompanied with deranged sexual nervous power. Prof. J. M. Scudder (*Dis. of Child., Spec. Med.*), preferred this to all other drugs in *epilepsy*, though he did not claim it would cure all cases. He regarded the remedy as a nerve stimulant, and used it where the symptoms pointed to enfeebled cerebral circulation, and to relieve irritation of the brain and spinal cord giving rise to convulsive disorders. The cases were those of disordered innervation, the movements being epileptiform, or partially spasmodic, with enfeebled cerebro-spinal centers. Where the tendency was to repeated convulsions from slight causes, he employed it to relieve the predisposition; and when convulsions had already occurred, and had been checked by other means, he used bromide of ammonium to prevent their recurrence. Foltz (*Dynam. Therapeutics*) uses it in *nervous deafness*, and to relieve the tinnitus from the use of cinchona alkaloids; it is also a remedy for nervous twitching and jerking of the eyelids and ocular muscles. Ammonium bromide will promote sleep when *insomnia* is due to cerebral excitement (Locke). The dose is from 1 to 30 grains (1 to 5 grains for children), well diluted with water, which may be repeated 2 or 3 times a day; it is best taken dissolved in water.

Specific Indications and Uses.—Tendency to convulsions; epileptiform disease; convulsions when there is a return to consciousness; sudden movements of the body and limbs, jerking of tendons, facial twitching, with eyes turned upward; lack of ocular accommodation. Spasmodic or convulsive cough; whooping-cough. A minor indication is, small pulse with unusual pallor of the skin, though one is not to be guided by this alone.

AMMONII CARBONAS (U. S. P.)—AMMONIUM CARBONATE.

FORMULA: $NH_4HCO_3.NH_4NH_2CO_2$. MOLECULAR WEIGHT: 156.77.

SYNONYMS: *Mild volatile alkali*, *Volatile salt*, *Sesquicarbonate of ammonia*, *Hartshorn*, *Sal volatile*, *Preston's salt*, *Smelling salt*, *Alkali volatile*, *Sal volatile siccum*, *Ammoniæ sesquicarbonas*, *Carbonas ammonicus*.

Source and History.—By distilling decomposed urine, Raymond Lully was the first to prepare this salt. Afterwards it was found that it could be obtained by distilling such nitrogenous material as blood, hoof, horn, and other animal tissues (salt of hartshorn), after which it was purified with animal charcoal. Sal ammoniac and sal tartar were later employed by the monk Basil Valentine, but still later chalk was substituted for the potassium salt. The principal source of ammonium carbonate is coal-gas liquor, as described under *Ammonia*.

Preparation.—Take of finely powdered chloride of ammonium, 1 pound; carbonate of calcium (chalk), finely powdered and dried, 1½ pounds. Mix them together thoroughly, and subject the mixture in a retort with a proper receiver to a gradually increasing heat so long as any vapors sublime—(*Ed.*). By this process calcium chloride is yielded, which remains in the retort, while ammonia, water, and carbonate of ammonium distill over, and the latter condenses in the cooler portions of the condenser as a white sublimate. This product is not the neutral carbonate of the composition $CO_3(NH_4)_2$, but a mixture of equal molecules of *hydrogen ammonium carbonate* (acid or bicarbonate of ammonium) and *carbamate of ammonium*. The reaction resulting from the above operation may be thus expressed: $4NH_4Cl+2CaCO_3=NH_4HCO_3.NH_4NH_2CO_2+2CaCl_2+NH_3+H_2O$. Its empirical formula would be represented by $N_3H_{11}C_2O_5$.

Description and Tests.—Ammonium carbonate is in the form of "white, hard, translucent, striated masses, having a strongly ammoniacal odor without empyreuma, and a sharp, saline taste. On exposure to the air, the salt loses both ammonia and carbonic acid, becoming opaque, and is finally converted into friable, porous lumps, or a white powder"—(*U. S. P.*). The valuable constituent of this salt is its volatile portion—that which makes up the *carbamate of ammonium*—and the change above mentioned when the salt is exposed to the air, is due to the escape of this substance. The remaining light, porous, friable masses or powder, which lack the ammoniacal pungency, consist of the bicarbonate of ammonium. Hence it will be seen at once that the product should be kept in securely glass-stoppered bottles, in a cool place, and not, as is often the case, in drawers and casks, if its full therapeutic properties are to be preserved. In making such preparations as *Liquor Ammonii Acetatis*, only the translucent lumps should be employed, as they alone contain the active medicinal agent, the *ammonium carbamate*. Ammonium carbonate that has decomposed, should be discarded. This salt is sometimes found to have a slightly pinkish color, due to iron present as an impurity. When condensed in a leaden receiver, small fragments or clippings of lead may be found adherent to the surface.

Ammonium carbonate is "slowly but completely soluble in about 5 parts of water at 15° C. (59° F.); decomposed by hot water with the elimination of carbonic acid and ammonia. By prolonged boiling with water, the salt is completely dissipated. Alcohol dissolves the carbamate ($NH_4NH_2CO_2$), and leaves the acid carbonate (ammonium bicarbonate). When heated, the salt is completely volatilized, without charring. The aqueous solution possesses a strongly alkaline reaction, and effervesces with acids"—(*U. S. P.*). It is incompatible with acids, caustic potash, or caustic soda, magnesia, alkaline carbonates, lime-water, chloride of calcium, alum, bitartrate of potassium, bisulphate of potassium, bichloride of mercury, most salts of iron and lead, sulphate of zinc, etc. Combined with sulphate of quinine, in fluid or solid form, decomposition ensues, with the formation of sulphate of ammonium and quinine.

"A 5 per cent aqueous solution of the salt, slightly supersaturated with acetic acid, should not be affected by hydrogen sulphide T.S. (absence of metals), nor by barium chloride T.S. (sulphate), or ammonium oxalate T.S. (calcium). A 5 per cent aqueous solution, on the addition of a slight excess of silver nitrate T.S., and subsequent supersaturation with nitric acid, should neither assume a brown color (absence of hyposulphite), nor become more than slightly opalescent within 2 minutes (limit of chloride). If 1 Gm. of the salt be slightly supersaturated with nitric acid, and the solution evaporated to dryness on a water-bath, it should afford a colorless and odorless residue, which, upon gentle ignition, should be completely volatilized (absence of empyreumatic or non-volatile matters). If 7.84 Gm. of unaltered ammonium carbonate be dissolved in water to the volume of 90 Cc., 30 Cc. of this solution (containing 2.613 Gm. of the salt) should require, for exact neutralization, 50 Cc. of normal sulphuric acid V.S. (each cubic centimeter corresponding to 2 per cent of the pure salt), rosolic acid being used as indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Carbonate of ammonium quickly enters the blood, increasing its alkalinity, and is chiefly eliminated by the kidneys and somewhat less by the skin and lungs. The renal, cutaneous, and bronchial secretions are augmented by it, and in health it is asserted to elevate the temperature somewhat. Moderate doses (5 to 10 grains) increase the force and volume of the circulation, with sometimes a sense of constriction or throbbing in the head. In large doses it is a powerful irritating poison; in small doses it is an energetic diffusible stimulant and antispasmodic. The effects of an overdose are gastro-intestinal inflammation, pains in the abdomen, convulsions, nervous derangement, and death. When fatal doses have been swallowed, the post mortem signs are gastro-intestinal inflammation, with pulmonary congestion and œdema. Ammonium carbonate should not be administered for any great length of time, for besides neutralizing the acid of the gastric juice and producing diarrhœa and like disturbances, it destroys the blood, with symptoms resembling scurvy, and increases tissue waste in a degree to cause pallor, debility, and emaciation. The antidotes to acute poisoning by this agent are diluted acids, with demulcents and protectives to allay the after-effects.

Ammonium carbonate is stimulant, diaphoretic, and expectorant. In doses of 20 to 30 grains, it is emetic. Its stimulating properties render it useful in low *continued fevers*, in which it acts without increasing the circulation or the cerebral functions. In *typhoid fever* it may be used where alcohol would irritate. It is also useful as an antacid in *gastric derangement* from dissipation, *epilepsy*, and *sick-headache*. As a remedy to sober drunken individuals, it is very prompt, but less efficient than the solution of the acetate; in *delirium tremens*, with cerebral anemia and weak circulation, it may be used to advantage. It has also proved of great value in certain *cutaneous affections*, *psoriasis*, *lepra*, etc. Combined with guaiacum, it has been serviceable in *chronic rheumatism*, and has likewise proved beneficial in *epilepsy*, *hysteria*, *chorea*, *scrofula*, and other chronic disorders, more especially when these are attended with acidity and debility of the digestive organs. Full doses have been given to occasion vomiting in *paralysis*. "In broken down constitutions with greatly diminished vitality, when an antacid is needed, this is the best remedy known" (Locke's *Syllabus*, 215). Give 5 grains in sweetened water. It is especially serviceable in *prostration* from acute disease (Scudder, *Dis. of Child.*, 39). It is a prompt agent, both internally and locally, to relieve the distressing symptoms from *insect* and *serpent bites*. *Amenorrhœa* and *dysmenorrhœa*, of asthenic character, are benefited by it. In *lung diseases*, with marked enfeeblement and bronchial dilatation, it is advantageous; and in the latter stage of *typhoid pneumonia*, it may be given in an infusion of boneset. Here it acts as a tonic and expectorant, lessening secretion, making expectoration easier, and sustaining the strength of the patient (Locke). Following the specific indications below, it will be found valuable in many disorders, whether it be a commencing *coryza*, the *exanthemata*, or other conditions. Externally, ammonium carbonate is a gentle rubefacient, but is seldom employed as such. The dose is from 5 to 20 grains every 3 or 4 hours, in the form of a pill or dissolved in some aqueous vehicle. For its specific use, the dose preferred is from $\frac{1}{10}$ to 1 grain every hour.

Specific Indications and Uses.—Feeble pulse, imperfect surface circulation, pallid or dusky, cold skin, difficult breathing, restlessness and insomnia (from debility). As a stimulant where alcohol is inadmissible; broken-down constitution, with low vitality and acidity of the stomach; feeble heart, with aching sensations about the organ; tendency to fainting and collapse; distressing cough, with viscid, scanty and difficult expectoration, particularly in the aged.

Smelling Salts.—Formerly ammonium carbonate was much used under the name of *Smelling Salts*, combined with some aromatic oil, as a stimulant in *hysteria*, *fainting*, *headache*, etc. An old and popular *salt* may be made as follows: Take oil of cloves, 1 fl℥; oil of lavender, 2 fl℥; essence of bergamot, 5 fl℥; liquor ammoniæ, specific gravity 0.880, 1 pint. Mix, and make an essence. Fill the bottles with rough carbonate of ammonium, then add as much of the above essence as the salt will absorb.

Related Compounds.—Hydrogen Ammonium Carbonate, or *Bicarbonate of ammonium* (NH_4HCO_3), described on p. 174, is the white salt left when commercial ammonium carbonate is exposed to the atmosphere, or when the carbamate is separated from it by solution in alcohol. About 8 parts of water dissolve it. When dry it does not give off the odor of ammonia. It sometimes occurs in crystalline condition "in Patagonian guano and in the purifiers of gas-works" (Lloyd's *Chem.*). It is without value as a medicine.

Ammonium Carbamate.—This constituent of commercial ammonium carbonate is a crystalline, deliquescent powder. It has the pungent odor of ammonia gas, and when heated in a sealed tube to 140° C. (284° F.), it is decomposed, water and urea resulting. It may be prepared by bringing together dry carbon dioxide and dry ammonia gas, or by passing both gases into cold absolute alcohol. When this salt is left in aqueous solution it forms *normal ammonium carbonate*, thus: $NH_4NH_2CO_2 + H_2O = (NH_4)_2CO_3$. So that when commercial carbonate of ammonium is brought into watery solution, the latter contains some normal ammonium carbonate, and the remaining acid carbonate may be converted into the same by adding to the solution a little aqua ammoniæ. Such a solution is valuable as a reagent.

Ammonium Embellicum ($C_9H_{13}O_2.NH_4$). This ammonium salt of embelic acid is a brick-red powder, soluble in diluted alcohol. In pills of 3 (children) to 6 (adults grains, it is reported an efficient tænicide.

Ammonium Borate, *Ammonium biborate* ($2[NH_4HB_2O_4].3H_2O$).—Dissolve in warmed ammonia water, specific gravity 0.960 (3 parts), boric acid (1 part, in excess), and allow the solution to slowly cool. Crystals form, which are alkaline in taste and reaction, and on exposure effloresce, with a loss of ammonia, changing gradually to the tetraborate. It dissolves in water (1 in 12). Dose: From 10 to 20 grains in liquorice water every hour. Highly praised in *renal colic, calculus,* and *chronic vesical catarrh.*

Ammonii Uras, *Ammonium urate* ($C_5H_3[NH_4]N_4O_3$).—An acid compound prepared by digesting uric acid in ammonia water, or by dissolving in solutions of other urates a sufficient quantity of ammonium chloride. It is present in most grades of guano. Ammonium urate is an amorphous, white powder, not very soluble. It has been used as an ointment (20 grains to 1 ounce) in *chronic eczematous disorders.*

Ammonii Arsenas, *Ammonium arsenate* ($[NH_4]_2H.AsO_4$).—Efflorescent crystals of an alkaline salt obtained by adding a solution of ammonia, or carbonate of ammonium, to strong solution of arsenic acid, and spontaneously evaporating the same. Half the ammonia is dissipated upon exposure to air. From 20 to 25 drops (in divided doses throughout the day) of a solution of 1 grain of ammonium arsenate in 1 fluid ounce of pure water, has been lauded in stubborn *skin affections.*

Ammonium Salicylate, *Salicylate of ammonium.*—This agent may be prepared extemporaneously in neutral solution as follows: ℞ Acid salicylic, ʒij; ammonium carbonate, grs. cxl; aqua menthæ piperitæ, fl℥iv. Mix. The dose of this preparation is from 1 to 2 fluid drachms every 2 hours. This drug comes highly recommended as an abortive of *typhoid* and *remittent* and allied *fevers.* It is classified as antiseptic, germicide, antipyretic, stimulant, and analgesic. Several observers declare it the best salt of salicylic acid. It is claimed that it will generally abort the above-named fevers, and should it fail to do so it will render their course much milder. It readily reduces temperature and holds it down. It modifies or checks the intestinal discharges, and yet when *constipation* is present, is said to operate as a laxative. The *headache* of these fevers is said to be promptly controlled, and sleep is favored by it. The skin and kidneys become more active under its use, and the urine assumes a paler hue, and if offensive, is partially deodorized. Prof. Webster (*Dynam. Ther.*, 53) reports success with it. It deserves investigation.

Guano.—This valuable fertilizer is composed of the wholly or partially decomposed excrements of various sea-birds, notably the penguin, inhabiting the western shores of South America, and the coasts of Australia and Western Africa. The bulk of the commercial guano comes from the islands of the Pacific opposite Bolivia and Peru (Galapagos Islands). Guano usually comes in the form of grayish or light-brown powder, intermixed with friable lumps. It may be amorphous or crystalline. It is hygroscopic, absorbing from 6 to 20 per cent of moisture, becoming "tacky." Its odor is very offensive, somewhat ammoniacal. Though sometimes of acid reaction, guano is usually alkaline. Besides moisture, it contains organic matter and salts of ammonium, notably ammonium oxalate and carbonate, tricalcic phosphate, and other alkaline salts, uric acid, and salts of the same, phosphates, sulphates, and chlorides of calcium, magnesium, etc. Guano is largely soluble in water. An alkaloidal substance, *guanine* ($C_5H_5N_5O$), was found in it by Unger, in 1845. Nitrous acid, acting upon guanine, produces *xanthine* ($C_5H_4N_4O_2$), and this in turn has been converted into *caffeine* and *theobromine* (Fischer). *Guanine* is a constituent of pancreatic juice, and occurs as a crystalline, white powder, soluble in solution of caustic potash and acid media, but not in water, ammonia, alcohol, or ether. When burned, guano leaves from 25 to 40 per cent of a white ash. This disgusting substance has been administered internally in the form of a syrup, and was at one time applied topically, mixed with potter's clay, in various cutaneous disorders. Its irritating properties led to its abandonment as a medicinal agent. Its only use at present is as a fertilizer.

Ammonii Molybdas, *Ammonium molybdate* ($[NH_4]_2MoO_4$).—This is a salt of molybdic acid (H_2MoO_4) and ammonium, and may be prepared by dissolving molybdenum trioxide (MoO_3) in aqua ammoniæ, and, by means of alcohol, precipitating the salt so formed. It is a valuable test reagent for the detection of alkaloids and of phosphoric acid. When ammonium molybdate, in the presence of nitric acid, is added to phosphoric acid or a solution of a phosphate, *ammonium phosphomolybdate* ($11[MoO_3].[NH_4]_3PO_4.6H_2O$), is formed.

AMMONII CHLORIDUM (U. S. P.)—AMMONIUM CHLORIDE.

FORMULA: NH_4Cl. MOLECULAR WEIGHT: 53.38.

SYNONYMS: *Hydrochlorate of ammonium, Muriate of ammonia, Chlorhydrate of ammonia, Sal ammoniac, Purified ammonium chloride, Sal ammoniacum, Ammoniæ hydrochloras, Ammoniæ murias, Chloruretum ammonicum, Ammonium hydrochloratum depuratum, Ammonium muriaticum depuratum.*

Source, History, and Preparation.—Chloride of ammonium is found native, especially in the neighborhood of volcanoes, and in the waters of some mineral springs. It was first prepared in Egypt from the soot of camel dung by sublimation. Geber obtained sal ammoniacum from urine. At present it is prepared in various ways, for instance, by the union of dry hydrochloric acid gas and dry ammoniacal gas; or by the double decomposition of sulphate of ammonium and chloride of sodium. The sulphate of ammonium is obtained principally from gas-liquor, as described under *Ammonii Sulphas*. In order to obtain ammonium chloride from the ammoniacal gas-liquor direct, the latter is distilled with lime, and the ammonia thus formed is conducted into diluted hydrochloric acid. The solution, when sufficiently strong, is evaporated to dryness and the sal ammoniac purified by sublimation.

Description.—Ammonium chloride is usually sold in thick cakes, convex on one surface, concave on the other, colorless, translucid, tough, fibrous, permanent in the air if dry, but becoming slightly moist and unctuous to the touch if exposed to dampness; no odor, but possessing a pungent, saline, acrid taste. The salt is sometimes tinged or streaked with red, due to iron. It is an anhydrous salt of the composition NH_4Cl. Its specific gravity is 1.520. When dissolved in water, cold is produced during the solution. It is not readily reduced to powder, but this may be accomplished by making a strong aqueous solution, heating it to 100° C. (212° F.), stirring it constantly until it is cold; by this process granulation of the salt takes place, and after thoroughly drying it, it may be easily pulverized. It is decomposed by sulphuric and nitric acids; also by hydroxides of potassium, sodium, barium, and calcium. The official salt is thus described: "A white, crystalline powder, without odor, having a cooling, saline taste, and permanent in the air. Soluble in 3 parts of water at 15° C. (59° F.), and in 1 part of boiling water, but almost insoluble in alcohol. On ignition, the salt is completely volatilized, without charring. The aqueous solution of the salt is neutral to litmus paper, and affords with silver nitrate T.S. a white curdy precipitate, which is soluble in ammonia water. Another portion of the aqueous solution, when gently heated with potassium or sodium hydrate T.S., evolves the odor of ammonia. A 5 per cent aqueous solution of the salt should not be affected by hydrogen sulphide T.S. (absence of metals), barium chloride T.S. (sulphate), diluted sulphuric acid (barium), or ammonium oxalate T.S. (calcium). When acidulated with hydrochloric acid, the solution should not assume a red color on the addition of a few drops of ferric chloride T.S. (absence of sulphocyanate). 20 Cc. of a 5 per cent aqueous solution of the salt should not at once assume a blue color on the addition of 5 drops of potassium ferrocyanide T.S. (limit of iron). If to 1 Gm. of the salt a little nitric acid be added, and the mixture evaporated to dryness in a porcelain capsule on a water-bath, a white residue should be obtained which, when more strongly heated, should be completely volatilized (absence of empyreumatic or non-volatile matters)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Chloride of ammonium, according to its mode of employment, is refrigerant, laxative, expectorant, diaphoretic, or diuretic. "It acts primarily on the intestinal canal, as an irritating stimulus" (*Ed.*). Its action upon the general system is to promote secretion and exhalation generally, soften and break down textures, check phlegmonous inflammation, lessen inflammatory effusions, and promote their re-absorption. It is said to act upon all the tissues of the system, producing the solvent effects accorded to mercurials, but without their injurious consequences. If long employed, it may occasion gastro-intestinal disturbances, with coated tongue, anorexia, difficult digestion, pain, vomiting, diarrhœa and loss of flesh. It has a tendency to produce hemorrhages, as epistaxis, hematuria, etc. In very large doses, it acts as a decided irritant, producing inflammation of the alimentary canal, and also coma and tetanic convulsions. In *mucous diseases of the throat, nasal passages*, and *Eustachian pavilion*, it has been beneficially employed in the form of spray, of from 5 to 125 grains of the salt to an ounce of water; or the impalpable powder may be used in the form of powder-spray, alone, or in combination with powdered extract of liquorice, etc. The vapor of chloride of ammonium passed into the inner ear, through the Eustachian tube, by means of an instrument for this purpose, has effected cures of *chronic mucous diseases* of these parts. As an external application, it is used in the form of plaster or lotion, as a stimulating discutient, and has been found valuable in *chilblains*, "*indolent tumors* of all kinds, *contusions*, *gangrene*, *psora*, *ophthalmia*, *sore throat*, and in stimulating clysters;" and it is also very beneficial in *hemicrania* and other *neuralgic affections*, in which it may also be given in doses of a tablespoonful every hour, of a solution of 2 drachms dissolved in 6 fluid ounces of water, and continued until relieved. When first applied, in solution, the coldness will diminish the sense of heat and uneasiness of the part, and the subsequent stimulus will excite a more healthy action in the vessels. For these purposes a favorite lotion with some physicians is a mixture of 2 drachms of chloride of ammonium dissolved in 1 fluid ounce of distilled water, to which 1 fluid ounce of tincture of conium is subsequently added. In *erysipelas* and *erysipelatous inflammations*, I have found the following mixture an excellent local application: Take of chloride of ammonium 1 ounce, distilled water ½ pint; mix and dissolve, then add tincture of camphor 4 ounces, tincture of lobelia 4 ounces. To be shaken each time previous to bathing with it. It allays the burning heat and itching, and in many instances assists in preventing the further development or extension of the disease (King). As a gargle or in spray, it is often serviceable in the chronic form of *tonsillitis;* use a solution of 1 or 2 drachms of the salt to about 2 or 2½ fluid ounces of water, and 4 fluid drachms of alcohol. In *fluor albus* and *gonorrhœa* (as well as for a wash in *scabies* and *ulcers*), from 1 drachm to ½ ounce may be dissolved in 12 or 16 fluid ounces of water, and used as an injection. A solution (℥ss in aqua fl℥viij), is declared by Foltz to be the best agent for *palpebral ecchymosis*, and if applied early, prevents the discoloration (*Dynam. Therap.*).

Internally, ammonium chloride has been recommended in all *tuberculous diseases*, in *chronic pulmonary affections*, *rheumatic face-ache*, *hemicrania*, *ischuria*, *chronic enlargement of the prostate*, *chronic rheumatism*, *chronic bronchitis*, *neuralgia*, *nervous headache*, *chronic dysentery*, *amenorrhœa*, the result of deficient uterine action, and in all chronic diseases of mucous or serous tissues. In these cases we will be largely guided by the indications pointed out by Prof. Scudder—cases showing feeble capillary circulation, with dusky redness of the skin (not due to blood poisoning), the effacement of which is again slowly replaced by a return of the dark color. · The drug is a capillary stimulant, and as such is frequently of benefit in the *exanthemata*, to favor the eruptive process. In *broncho-pulmonary disorders*, it is a valuable remedy. It is a remedy for dryness and tightness in the throat, with sharp, violent cough. *Throat disorders*, especially when chronic, with a tight, rasping cough, precipitated by a titillating or tickling in the larynx, is promptly relieved by the following: R Ammonium chloride, ʒij; sanguinarine nitrate, gr. j; spts. lavender compound, flʒij; syrup, q. s. fl℥iv. Mix. Filter through cotton. Dose, 1 teaspoonful every 3 hours. It is also useful early in *bronchitis*, and the active stage of *catarrhal pneumonia* (1 to 3 grains every 2 or 3 hours). *Cough*, associated with sluggish abdominal circulation and hepatic torpor, and subdued cough with scanty secretion, are met by ammonium chloride in small doses. It is asserted to relieve *hepatic neuralgia—heptalgia*—and to be of value in *chronic catarrhal disorders of the intestinal tract*. The pain attending *biliary catarrh* is also said to be controlled by it. Dose: From 5 grains to ½ drachm is the dose, which may be repeated 3 or 4 times a day; it may be given in the form of a powder, mixed with powdered gum or sugar, or dissolved with syrup, mucilage, extract of liquorice, etc. In large doses it purges, but in small doses it rather constipates the bowels. It may be given for a long time without any inconvenience, but at last it impairs the digestive powers.

Specific Indications and Uses.—Dusky or dull redness (non-septic) of surface, easily effaced but slowly returning; cough, subdued, tight, rasping or tickling, with scanty secretion; cough dependent on hepatic torpor and imperfect abdominal circulation. Locally to ecchymosis of the lids; also as a bath in capillary enfeeblement.

AMMONII IODIDUM (U. S. P.)—AMMONIUM IODIDE.

FORMULA: NH_4I. MOLECULAR WEIGHT: 144.54.

SYNONYMS: *Iodurctum ammonicum*, *Ammonium jodatum*.

Preparation.—Place iodine, a sufficient quantity, into a dish, and add to it enough water to cover it, then add sulphide of ammonium, agitating from time to time, and continue the addition of the sulphide until the red color has disappeared; boil, to drive off the excess of the sulphide, filter, and evaporate to dryness. This process yields a salt to which traces of sulphur obstinately adhere, and even when excluded from light, discoloration is liable to occur, with evolution of free iodine. A formula has, therefore, been proposed by Mr. Jas. F. Babcock, which produces a salt absolutely pure, and which, if carefully dried, is said to remain white for a considerable period. The process consists in the double decomposition of pure iodide of potassium and pure sulphate of ammonium, forming iodide of ammonium and sulphate of potassium; it is as follows: Dissolve by heat, iodide of potassium, 5 parts by weight, and sulphate of ammonium, 2 parts by weight, in distilled water, 4 parts by weight. On cooling, a large proportion of sulphate of potassium is deposited; and when the fluid is at 15.5° C. (60° F.), alcohol (95 per cent), 1 part by weight, is mixed with it, which separates all but about 1 per cent of sulphate of potassium, and the concentrated solution of iodide of ammonium, after evaporation, yields crystals of perfectly white iodide. Subsequent addition of alcohol will separate the whole of the sulphate of potassium from the mother liquor, which, on evaporation to dryness, will yield an additional quantity of the iodide. To give the best results, the evaporation should be performed in the dark, or in the evening by gas-light. The solution being very concentrated, will require but comparatively little boiling, and the precipitate of sulphate of potassium being crystalline, can be readily separated by filtration (*Proceedings Amer. Pharm. Assoc.*, 1866, p. 245).

This salt may also be produced directly by combining iodine with ammonia water. This mixture, however, should be prepared with the greatest of caution, as nitrogen iodide, an extremely dangerous explosive compound, is formed simultaneously with the ammonium iodide. In this way the so-called colorless tincture of iodine is prepared. The simplest and safest way of obtaining ammonium iodide is to neutralize hydriodic acid (IH) with aqua ammoniæ, and evaporate to dryness. This process is 50 per cent more expensive than by the older method (Lambert). Another process consists in preparing ferrous iodide, precipitating the iron with aqua ammoniæ, and evaporating the filtrate to dryness. Another process was introduced by Rother (*Amer. Jour. Pharm.*, 1887), consisting in the double decomposition of calcium iodide with ammonium bicarbonate.

Description and Tests.—Iodide of ammonium occurs as "minute, colorless, cubical crystals, or a white, granular powder, without odor when colorless, but emitting a slight odor of iodine when colored, and having a sharp, saline taste. The salt is very hygroscopic, and soon becomes yellow or yellowish-brown on exposure to the air and light, owing to the loss of ammonia and the elimination of iodine. Soluble at 15° C. (59° F.), in 1 part of water, and in 9 parts of alcohol; in 0.5 part of boiling water, and in 3.7 parts of boiling alcohol. When heated on platinum foil it evolves vapor of iodine, and volatilizes completely without melting. The aqueous solution of the salt is neutral to litmus paper, and, when gently heated with potassium or sodium hydrate T.S., evolves the odor of ammonia. If a little chloroform be added to 10 Cc. of the aqueous solution, then a few drops of chlorine water, and the whole agitated, the chloroform will acquire a violet color. A solution of 1 Gm. of the salt in 20 Cc. of water, acidulated with a few drops of diluted hydrochloric acid, should not afford an immediate cloudiness or precipitate with 5 drops of barium chloride T.S. (limit of sulphate). A 1 per cent aqueous solution of the salt should not at once assume a blue color with potassium ferrocyanide T.S. (limit of iron), nor, after being mixed with a little starch T.S., should it assume a deep-blue color (limit of free iodine). If 0.25 Gm. of the salt be dissolved in 10 Cc. of ammonia water, the solution then shaken with 19 Cc. of decinormal silver nitrate V.S., and the filtrate supersaturated with 5 Cc. of nitric acid, no cloudiness should make its appearance within 10 minutes (absence of more than about 0.5 per cent of chloride or bromide)"—(*U. S. P.*). "Ammonium iodide should be kept in small, well-stoppered vials, protected from light. When deeply colored, the salt should not be dispensed, but it may be deprived of free iodine by adding to its concentrated aqueous solution, sufficient ammonium sulphide T.S. to render it colorless, then filtering, and evaporating on a water-bath to dryness"—(*U. S. P.*). The coloring of the salt red by the liberation of free iodine, may be overcome by triturating the salt with a few drops of hypophosphorous acid, which combines with the iodine to form a product which does no harm, and at the same time the salt is freed from the irritating qualities it may possess when free iodine is present.

Action, Medical Uses, and Dosage.—The action of ammonium iodide is somewhat analogous to that of iodide of potassium, its therapeutic effects being, however, more rapidly evidenced. It frequently produces diuresis, and also appears to have a well-marked and satisfactory influence in the reduction of glandular swellings. It has been very successfully employed in *scrofula*, *constitutional syphilis*, *glandular enlargements*, *chronic rheumatism*, *phthisis pulmonalis*, and in *strumous disorders* generally. It is of great value in the localized *headache of syphilis*, and is indicated in dull headache from strumous disorders and other causes, with feeble, sluggish circulation, dizziness, unsteady gait, and difficulty in controlling voluntary movements. The pain seems confined to a small area, as in inflammation, which may be covered with the finger tip. In *pericranial headache*, with cerebral excitement, it is also a good remedy. In *secondary syphilis*, it gives good results where the "tissues give the pinched and stringy sensation to the touch" (Scudder, *Spec. Diag.*, 144). Foltz values it in *syphilitic eye disease*, with depression, giving 2 grains every 2 hours; also in *syphilitic disease of the internal and middle ear*, particularly in *suppurative otitis media*, he considers it one of the most useful of agents (*Dynam. Therap.*). The dose for an adult is from 1 to 3 grains, repeated 3 or 4 times a day; it may be taken dissolved in water. A liniment made by dissolving ½ drachm of the iodide in 1 ounce of glycerin, and applied to *enlarged tonsils* by means of a camel's-hair brush, once or twice a day, has, in the course of three or four months, aided by internal use of the salt, effected their complete and permanent reduction. The same liniment employed in frictions, has been found beneficial in *nocturnal syphilitic pains* of the muscles or joints. An ointment (20 or 30 grains to 1 ounce of lard) has been efficacious in *lepra* and *psoriasis*, and in what is known as "*camp or prairie itch*," applying about ½ ounce of it in frictions, twice a day. But a small quantity of this ointment should be prepared at a time, and kept in well-stoppered vessels, as the action of the air decomposes the iodide.

Specific Indications and Uses.—Localized pain in the head; dull pain in the head, with tinnitus aurium; vertigo; unsteady gait, and difficulty in controlling muscular movements; circulation feeble and sluggish; pericranial headache, with cerebral excitement; secondary syphilis, with stringy, pinched tissues; syphilitic diseases of the eye and ear, with depression.

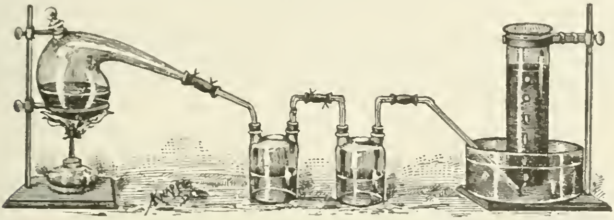
AMMONII NITRAS (U. S. P.)—AMMONIUM NITRATE.

FORMULA: NH_4NO_3. MOLECULAR WEIGHT: 79.9.

SYNONYMS: *Ammonium nitricum*, *Nitrum flammans*, *Ammoniæ nitras*, *Nitrate of ammonia*.

Preparation and History.—Nitrate of ammonium (discovered by Glauber) has been known for a great many years, and was formerly termed *nitrum flammans*. It is readily prepared by adding ammonia, or ammonium carbonate, to diluted nitric acid, until the mixture becomes neutral, and then evaporating it slowly to crystallization. As found in the market, for the purpose of making nitrogen monoxide, it is in the form of a white, fibrous mass, in which case it is prepared by quick boiling until a portion will become solid when placed upon a cold porcelain slab. The mass is then allowed to cool, broken into fragments, and preserved in a cool place. As thus prepared it is known by the name *fused nitrate of ammonium.* This salt was of little interest until the introduction of nitrous oxide, when a demand for it was created. When ammonium nitrate and manganese dioxide in equal amounts are heated together, at the temperature of from 182° to 204° C. (360° to 400° F.), pure nitrogen is evolved, but above 212° C. (420° F.), teroxide of nitrogen and oxygen accompany (*Chem. News*, Vol. XXXV). Dry ammoniacal gas is absorbed in large amount when passed over ammonium nitrate, attended by liquefaction of the salt. At 0° C. (32° F.), half the weight of the salt will be condensed (*Phil. Trans.*, 1873). When quickly raised to a high temperature, dry nitrate of ammonium decomposes into nitrogen, water, and nitric oxide, whereas, when gently heated, in an apparatus, as illustrated below, it forms water, and *nitrogen monoxide* (N_2O), or nitrous oxide.

Fig. 17.



Description and Tests.—This salt is thus described in the *U. S. P.*: "Colorless crystals, generally in the form of long, thin, rhombic prisms, or in fused masses, without odor, having a sharp, bitter taste, and somewhat deliquescent. Soluble at 15° C. (59° F.), in 0.5 part of water, and in 20 parts of alcohol; very soluble in boiling water, and in 3 parts of boiling alcohol. When gradually heated, it melts at 165° to 166° C. (329° to 330.8° F.); at a temperature between 230° C. (446° F.) and 250° C. (482° F.) it is decomposed into nitrogen monoxide gas and water, leaving no residue. The aqueous solution of the salt is neutral to litmus paper, and when gently heated with potassium or sodium hydrate T.S., it evolves the odor of ammonia. On heating the salt with sulphuric acid, it emits nitrous vapors. A 10 per cent aqueous solution of the salt, when acidulated with nitric acid, should not be affected by silver nitrate T.S. (absence of chloride), nor by barium chloride T.S. (absence of sulphate)"—(*U. S. P.*). This salt should be kept closely stoppered.

Action, Medical Uses, and Dosage.—Ammonium nitrate is employed principally in the preparation of nitrous oxide, or "laughing gas." It has rarely been employed therapeutically. Dr. Walter Coles (*Am. Med. Times*, November, 1860, p. 311) has advised its use as a tonic, and for the purpose of introducing an increased quantity of oxygen into the system. It certainly has been found beneficial in cases of *excessive debility* from *suppurating abscesses* or *ulcers*, where the mucous tissues present a dark appearance, and has, apparently, been of service in several *diabetic patients.* The dose is from 5 to 15 grains, repeated 2 or 3 times a day.

AMMONII PHOSPHAS.—AMMONIUM PHOSPHATE.

FORMULA: $(NH_4)_2HPO_4$. MOLECULAR WEIGHT: 131.82.

SYNONYMS: *Phosphate of ammonia, Diammonium orthophosphate, Phosphas ammonicus, Ammonium phosphoricum, Ammoniæ phosphas.*

Preparation.—Pour syrupy phosphoric acid gradually into ammonia water until of slight acid reaction, then add ammonia water until it is slightly alkaline. Evaporate the solution to crystallization and dry the crystals by exposure to cool air.

Description.—Phosphate of ammonium forms large, transparent crystals, odorless, of a cooling, decidedly saline taste, insoluble in alcohol, and soluble in about twice its weight of water. In damp air it slightly effloresces through loss of ammonia, and when heated with hydroxides of sodium or potassium evolves ammonia. Normal ammonium phosphate occurs in guano.

Action, Medical Uses, and Dosage.—This salt was recommended in 1846, by Dr. T. H. Buckler, for the cure of *gout* and *rheumatism*, and though the grounds upon which he commended its use are not tenable, yet the article has been found useful in these affections, and in some diseases of the urinary apparatus. The dose varies from 10 to 40 grains in ½ fluid ounce of water, and repeated 2 or 3 times a day.

Related Salt.—AMMONII SODII PHOSPHAS, *Ammonium sodium phosphate, Microcosmic salt.* Formula: $(NH_4)NaHPO_4+4H_2O$. This salt has been obtained by the alchemists from evaporated urine; hence the name, microcosmic salt, implying man, or microcosm, being contrasted with the world at large, or macrocosm. It is obtained by crystallizing a mixture of 5 parts of sodium phosphate (Na_2HPO_4) and 2 parts of mono-ammonium phosphate ($H_2NH_4PO_4$). Microcosmic salt occurs in transparent, monoclinic prisms, easily soluble in water. To the taste it is distinctly saline. When heated in the loop of a platinum wire, in a Bunsen burner, it first loses ammonia and water, leaving a residue of dihydrogen sodium phosphate, and when further heated, forms a clear, glass-like bead of sodium hexa-meta-phosphate, which dissolves certain metallic salts with characteristic colors, hence its application in blow-pipe analysis. Microcosmic salt occurs also in guano.

AMMONII PICRAS.—AMMONIUM PICRATE.

FORMULA: $NH_4C_6H_2(NO_2)_3O$. MOLECULAR WEIGHT: 245.58.

SYNONYMS: *Picrate of ammonium*, *Carbazotate of ammonium*.

Preparation.—Add 1 part of picric acid to 8 parts of distilled water, and bring the mixture to the boiling point. Then, with constant stirring, add aqua ammoniæ until in slight excess, and filter through paper while hot. Mix the filtrate with 8 parts of alcohol, and, when cool, strain, and dry the precipitate on blotting paper, by exposure to the atmosphere.

The picric acid unites with ammonia in the foregoing operation, forming a dark orange-colored solution (picric acid dissolves with lemon-yellow color), from which the mechanical impurities are separated by filtration through paper. Owing to the fact that picrate of ammonium is almost insoluble in alcohol, and is soluble to a considerable extent in water, the alcohol is added, thus precipitating a larger amount than could be obtained by crystallization. Another advantage derived from the use of alcohol, results from the fact that a common impurity in commercial picric acid is a resinous substance produced by the action upon carbolic acid of the acids employed in making the picric acid. This resin is held in solution by the alcohol, but precipitates with the picric acid if water only is used.

Description.—Picrate of ammonium, obtained by the preceding formula, is in the form of minute lemon or orange-colored acicular crystals. It is intensely bitter, and imparts, in solution, a permanent yellow color to organic bodies, more particularly such as horn, the finger-nails, hair, etc. Solution of picrate of ammonium precipitates most of the solutions of alkaloidal salts, forming insoluble picrates of the alkaloids.

Action, Medical Uses, and Dosage.—Administered for some time to certain animals, it has occasioned a yellow discoloration of the conjunctiva, as well as of the urine; also diarrhœa, leanness, flatulency, spasmodic twitchings, etc.; and the globules of the blood, both the red and the white, become seriously changed in their character. With man, somewhat similar effects have been observed.

At one time this agent was highly extolled as an effective remedy for *intermittent fever*, and was also suggested for the destruction of *trichina* in man, but no positive or satisfactory results have been derived from its employment in these cases. Its chief use at the present day is in the preparation of colors for staining in histological investigations. The dose is ⅛ to ½ grain. On account of its intense bitterness, it should be administered in pill or capsule.

AMMONII SULPHAS.—AMMONIUM SULPHATE.

FORMULA: $(NH_4)_2SO_4$. MOLECULAR WEIGHT: 131.84.

SYNONYMS: *Sulphas ammonicus, Ammonium sulphuricum, Sulphate of ammonia, Sal ammonium secretum Glauberi.*

Source, History, and Description.—This salt was discovered by Libavius (Roscoe and S.), but was first investigated carefully by Glauber. It is mentioned in the early works on chemistry as *ammoniacal vitriol, vitriolic sal ammoniac,* and *Glauber's secrete sal ammoniac.* It is found in certain volcanic districts, but is made in immense amounts from ammoniacal gas-liquor, from which the ammonia is liberated by lime, and then conducted into diluted sulphuric acid; after which this solution of impure sulphate of ammonium is strained and evaporated until the salt separates. The impure brown mass formed is then recrystallized. Sulphate of ammonium occurs in long, transparent, 6-sided crystals, which are isomorphous with potassium sulphate, and have a strongly saline taste. They dissolve in their own weight of boiling, and in 2 parts of cold water; insoluble in alcohol of less specific gravity than 0.850. Sulphate of ammonium is made in large amounts in this country, and is mostly consumed in the preparation of ammonium alum, aqua ammoniæ, and chloride of ammonium. It also enters into the composition of ammonio-ferric alum, and is used to make other preparations of ammonium, such as iodide of ammonium, and as a fertilizer.

Medical Uses.—Sulphate of ammonium has not been employed as a therapeutical agent.

AMMONII VALERIANAS (U. S. P.)—AMMONIUM VALERIANATE.

FORMULA: $NH_4C_5H_9O_2$. MOLECULAR WEIGHT: 118.78.

SYNONYMS: *Ammonium valerate, Valerianus ammonicus.*

Preparation.—Pass ammonia gas into valerianic acid until the acid is saturated. Evaporate the solution to solidification and dissolve the mass in hot alcohol, from which the valerianate of ammonium separates on cooling.

Description.—Owing to its unstable qualities, this salt should be kept in well-stoppered containers. The official salt should correspond to the following description: "Colorless, or white, quadrangular plates, emitting the odor of valerianic acid, of a sharp and sweetish taste, and deliquescent in moist air. Very soluble in water and in alcohol; also soluble in ether. When heated, the salt fuses, gives off vapor of ammonia and of valerianic acid, and is finally completely volatilized. The aqueous solution has an acid reaction, and, when gently heated with potassium or sodium hydrate T.S., it evolves the odor of ammonia. If a concentrated, aqueous solution of the salt be slightly supersaturated with sulphuric acid, an oily layer of valerianic acid will separate on the surface. A 5 per cent aqueous solution, when acidulated with nitric acid, should not be affected by barium nitrate T.S. (absence of sulphate), nor by silver nitrate T.S. (absence of chloride). If a neutral solution of the salt be completely precipitated with ferric chloride T.S., the filtrate should not possess a deep-red color (absence of acetate)" —(*U. S. P.*). R. Rother, in 1884, proposed to substitute for ammonium valerianate an evaporated mixture of this salt with ammonia and borax, in order to overcome the objectionable odor (*Amer. Jour. Pharm.*, 1884, p. 313).

Action, Medical Uses, and Dosage.—Small doses stimulate, and large doses of ammonium valerianate depress the functions of the spinal cord (Parke). This salt has been highly recommended in *neuralgia, epilepsy, headache, nervous irritability, chorea,* etc. The dose of the salt is from 4 to 10 grains 3 times a day; of *Declat's solution* (containing $\frac{1}{25}$ part by weight of the salt), from 1 fluid drachm to $\frac{1}{2}$ fluid ounce, according to the urgency of the symptoms. For *epilepsy,* or other fully developed *convulsive disorders,* however, it is of no value whatever. *Elixir of Valerianate of Ammonium* is a preparation designed to disguise the disagreeable taste of the valerianate, and for which several formulæ have been proposed. One, about as useful as any, is as follows: Take, of valerianate of ammonium, 1 drachm; fluid extract of vanilla, $\frac{1}{2}$ fluid ounce; compound tincture of cardamom, 4 fluid drachms; tincture of prickly ash berries, 2 fluid drachms; syrup of orange flower, 6 fluid drachms; water, 3½ fluid ounces. Mix. The dose is a teaspoonful, to be repeated 3 times a day.

AMPELOPSIS.—AMERICAN IVY.

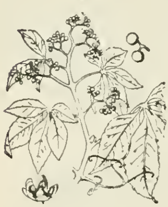
The bark and young twigs, with leaves, of the *Ampelopsis quinquefolia*, Michaux (*Vitis hederacea*, Willdenow; *Cissus quinquefolia*, Persoon; *Vitis quinquefolia*, Moench; *Cissus hederacea*, Barton).

Nat. Ord.—Ampelidaceæ.

COMMON NAMES: *American ivy*, *Virginian creeper*, *Five leaves*, *Woodbine*, *False grape*, *Wild wood vine*.

Botanical Source.—This is a woody vine, with a rooting, climbing stem, and quinate and digitate leaves composed of oblong, acuminate, petiolate, dentate, smooth leaflets which turn crimson in autumn. The flowers are inconspicuous, greenish or white, and borne in dichotomous clusters; calyx entire; petals 5, distinct and spreading; ovary 2-celled, cells 2-ovuled; style very short; berries dark-blue, acid, smaller than peas, 2-celled, cells 1 or 2-seeded.

Fig. 18.



A. quinquefolia.

History.—The American ivy is a common and familiar shrubby vine, climbing extensively, and, by means of its radicating tendrils, supporting itself firmly upon trees, ascending to the height of 50 feet; in the same manner it ascends and overspreads walls and buildings; its large leaves constituting a luxuriant foliage of dark glossy-green. It is found in wild woods and thickets throughout the United States, and blossoms in July, ripening its small blackish berries in October. The bark and twigs are the parts used. Its taste is acrid and persistent, though not unpleasant, and its decoction is mucilaginous. The bark should be collected late in the fall, after the berries have ripened. Bernays (*P. J. Tr.*, Vol. VII, p. 80) reports poisoning by the leaves, with severe emesis, diarrhœa, collapse, and narcosis, with dilatation of the pupils. This plant is frequently thought to be poison vine (*Rhus Toxicodendron*). It differs from the latter, however, among other ways, in having 5 instead of 3 leaflets, so that any one may easily differentiate the two vines. It may be handled with impunity. [Compare with illustration of *Rhus Toxicodendron*]. *Ampelopsin*, one of the old "resinoids or concentrations," is unworthy of consideration as a medicine.

Chemical Composition.—Analysis shows that the leaves and berries have the same constituents, differing only in the latter not containing *glycolic acid*. Analysis of the leaves gathered in midsummer, revealed albumen, pyrocatechin, sugar, tartaric acid (free), bitartrate of potassium, and tartrate of calcium, while neither free tartaric acid nor bitartrate of potassium were found in the leaves collected in early autumn (September), but two additional substances, pectin and calcium glycolate, were detected. The analyses were made by Wittstein and Gorup-Besanez.

Action, Medical Uses, and Dosage.—Alterative, tonic, astringent, and expectorant. Used principally in the form of syrup in *scrofula*, *syphilitic affections*, and wherever an alterative is required. It has also been recommended in *dropsy*, *bronchitis*, and other *pulmonary complaints*. Dose of the syrup or decoction, 2 to 4 fluid ounces, 3 times a day; tincture, 10 to 30 drops, 3 times a day.

Specific Indications and Uses.—In faulty nutrition, and scrofulous diathesis, with sluggish lymphatic action.

Related Species.—*Ampelopsis Botrya*, De Candolle. Habitat, southeast Africa. Diuretic. Root employed.

AMYGDALA.—ALMOND.

I. AMYGDALA AMARA (*U. S. P.*)—*Bitter almond.* "The seed of *Prunus Amygdalus*, var. *Amara*, De Candolle" (*U. S. P.*). (*Amygdalus communis*, var. *Amara*).

II. Amygdala Dulcis (*U. S. P.*)—*Sweet almond.* "The seed of *Prunus Amygdalus*, var. *Dulcis*, De Candolle" (*U. S. P.*). (*Amygdalus communis*, var. *Dulcis*

Illustration: Bentley and Trimen, *Med. Plants*, 99.

Botanical Source.—The Prunus Amygdalus, or Almond tree, is from 10 to 18 feet high, with a pale-brown, rugged bark, and dividing into many spreading branches. The leaves, which are borne on glandular petioles, are between 2 and 4 inches long, about 9 lines broad, lanceolate, acuminate, thin, serrated, bright light-green, and glandular near the base. The flowers are moderately large, pink or white, sessile, and in pairs, appearing before the leaves. The calyx is reddish, with blunt segments. The petals are variable in size, always much larger than the calyx, ovate, concave, and irregularly notched. Stamens spreading, about half the length of the petals. The ovary is wooly; the style simple. The fruit a leathery, hoary drupe, with the sarcocarp spontaneously cracking and dropping off the putamen. The stone is oblong, or ovate, acute, hard in various degrees, always rugged, and pitted with irregular holes. The seed is oblong, compressed, ovate, with brown testa, at the apex of which there is a broad, round, brown chalaza. The cotyledons are very large, and plano-convex. Both the sweet and bitter almonds are taken from this tree, of which there are several varieties—the sweet almond is obtained from the var. *Dulcis*, and the bitter almond from the var. *Amara* (L.).

Fig. 19.

Prunus Amygdalus.

History.—The Almond tree is indigenous to most of the southern parts of Asia and Barbary, and is cultivated in many parts of Southern Europe. According to Consul Mathews, of Tangier, the almond tree "is remarkable for the facility in raising it, for its hardiness in standing continued droughts, growing in the poorest soils, in the sands, gravels, and amongst rocks; and finally for the abundance of, and high price which its fruit commands. * * * At the sixth year the almond trees commence to yield by far greater product than the expenses incurred in their raising and cultivation, owing to their rustic habit, requiring no care from the time of their planting to the long period which these trees live" (*U. S. Special Consular Reports*, Vol. XL, 1889-90).

The varieties of sweet almond found in commerce are the Valencia, Italian, Barbary, and Jordan. The latter, which are the finest of the sweet almonds, come from Malaga. They are hard-shelled, though they are generally deprived of the shell before being put on the market. The Barbary variety is the smallest and cheapest. The soft-shell (*paper shell*) variety from Majorca of the Balearic Isles, is shipped from Valencia, and French and Italian ports on the Mediterranean coast. They are derived from *Prunus Amygdalus*, var. *fragilis*, De Candolle. The Jordan, or Malaga almonds, differ from all others in being much longer and of larger size. The bitter almonds are imported principally from Mogador, in Morocco. So far as the external appearance goes, they can not be differentiated from the sweet almonds, except the long Jordan variety. Almonds are now cultivated to some extent in California. The bitter variety is said to grow wild in Greece. The almond has been known from the earliest times, having been one of the presents carried down into Egypt by Jacob's sons (*Gen.*, ch. xliii, v. 11). Among the bitter almonds the following are the chief varieties: the French, the best product; the Sicilian; and the Barbary, or least valuable kernel.

Description.—I. Amygdala Amara (*U. S. P.*), *Bitter almond.* "About 25 Mm. (about 1 inch) long, oblong-lanceolate, flattish, covered with a cinnamon-brown, scurfy testa, marked by about 16 lines emanating from a broad scar at the blunt end. The embryo has the shape of the seed, is white, oily, consists of 2 plano-convex cotyledons, and a short radicle at the pointed end, and has a bitter taste. When triturated with water, bitter almond yields a milk-white emulsion, which emits an odor of hydrocyanic acid"—(*U. S. P.*).

II. Amygdala Dulcis (*U. S. P.*)—*Sweet almond.* "Closely resembling the bitter almond (see *Amygdala Amara*), but having a bland, sweetish taste, free from rancidity. When triturated with water, it yields a milk-white emulsion, free from the odor of hydrocyanic acid"—(*U. S. P.*).

Chemical Composition.—Both varieties of almond contain oil; the *sweet*, a fixed oil (see *Oleum Amygdalæ Expressum*); the *bitter*, a fixed oil (see *Oleum Amygdalæ Expressum*), and a glucoside, called *amygdalin*, capable of splitting into hydrocyanic acid, dextrose, and benzaldehyde (see *Oleum Amygdalæ Amaræ*). The fixed oil may be obtained by expression; it is colorless, or slightly yellowish, sweet and bland to the taste. The essential oil, called *oil of bitter almonds*, consisting of *benzaldehyde* (C_6H_5CHO), and hydrocyanic acid, may be obtained from the bitter almonds by first depriving them of their fixed oil by expression, subjecting the residue to the action of cold water for some hours, and finally distilling the product. The reaction involved is as follows: *Amygdalin* ($C_{20}H_{27}NO_{11}$) is converted, under the influence of *emulsin* (*synaptase*), a vegetable protein ferment present in the bitter and sweet almond, into dextrose, hydrocyanic acid, and benzaldehyde (oil of bitter almonds), as follows: $C_{20}H_{27}NO_{11}+2H_2O=CNH+2C_6H_{12}O_6+C_7H_6O$ (Wöhler and Liebig). *Emulsin* is non-poisonous, and is obtained in an amorphous state. Its activity upon amygdalin is destroyed by boiling heat. Another proteid body, which is likewise soluble in water, is present in the almonds. It was named *conglutin*, by Ritthausen, while Comaille denominated it *amandin*. It is to this body, and emulsin, that the emulsification of oil of almond in water is due. Amygdalin exists only in the bitter almond. On boiling amygdalin in alkaline solution, it splits up into *amygdalic acid* ($C_{20}H_{28}O_{13}$), and ammonia. With diluted acids, amygdalic acid yields *mandelic* (*phenylglycolic*) *acid* ($C_8H_8O_3$) and grape sugar. In 1895, E. Fischer succeeded in eliminating from the molecule of amygdalin one molecule of dextrose by acting upon it with an aqueous extract of beer yeast. He thus obtained a new glucoside ($C_{14}H_{19}NO_7$), which closely resembles amygdalin, and splits under the influence of emulsin into the same products; it differs from amygdalin in melting point and solubilities. The integuments of almonds contain both cane and grape sugar, the latter predominating, a green, resinous body, and a bitter, yellow principle having an acrid taste (thought to be a glucoside). Tannin has been found in the unblanched kernels. The almonds contain mucilage and protein matter, and yield in the ash, phosphates of calcium, potassium, and magnesium. *Amygdalin* is obtained also from many barks, flowers, seeds, and leaves of plants of the natural order Rosaceæ, those of the sub-orders Amygdaleæ and Pomeæ seeming to yield it in considerable amounts.

Amygdalin ($C_{20}H_{27}NO_{11}$), is obtained by freeing bitter almonds from their fixed oil by pressure and extracting the residue with boiling alcohol, evaporating the solvent and recrystallizing the residue. It is a crystalline body, has a sweetish bitter taste, is soluble in cold water (1 in 12), slightly soluble in cold, but easily soluble in hot alcohol, insoluble in ether. It is said to be poisonous, even in the absence of emulsin (Moriggia and Ossi). Its solution is lævo-rotatory. When crystallized, it contains three molecules of H_2O, which is expelled when amygdalin is heated to 120° C. (248° F.).

Seventeen grains of amygdalin dissolved in 1 ounce of emulsion of sweet almonds, furnishes 1 grain of pure hydrocyanic acid, an amount of acid equivalent to 50 minims of the official diluted hydrocyanic acid. The oil of bitter almonds is a poison acting in the same manner as hydrocyanic acid, unless the acid be removed from it by shaking with milk of lime and ferrous sulphate (Liebig and Wöhler). One drachm of it dissolved in 3 fluid drachms of alcohol, forms an "*essence of almonds*," much used by confectioners, perfumers, etc. The oil of bitter almonds has a golden-yellow color, an agreeable, prussic acid-like odor, and an acrid, bitter taste. It is combustible, burning with a white flame, its specific gravity varying from 1.060 to 1.070; soluble in alcohol or ether, and in water (300 parts); communicates its odor and taste to water, and yields foliaceous crystals of benzoic acid upon standing for a time exposed to the atmosphere.

Action, Medical Uses, and Dosage.—SWEET ALMONDS. Triturated with water, sweet almonds produce a white mixture called *emulsion* or *milk of almonds*, which possesses a very remarkable analogy with animal milk; it contains a great quantity of oil, kept in suspension in water by the presence of sugar, gum, and albumen, and is used as a demulcent and as a vehicle for other medicines. The oil, in small quantity, acts as a demulcent; in larger doses it is laxative. It is frequently employed in *cough*, diseases attended with *intestinal irritation*, and for mitigating the acrimony of the urine in *calculous affections*, *cystitis*, *gonorrhœa*, etc.

Externally the oil is sometimes used in lotions and cosmetics. The kernels have been made into a bread, as well as cakes and pudding, to take the place of wheaten bread in *diabetes*. Dose of the oil, 1 to 2 fluid drachms.

Bitter Almonds.—Bitter almonds are sedative, and in large doses poisonous. The toxic symptoms and treatment are those of hydrocyanic acid (which see). The oil of bitter almonds, or bitter almond water, is commonly employed, and may be used as a substitute for hydrocyanic acid. Dose of the oil, ¼ of a drop to 1 drop, in emulsion, and cautiously increased. Seldom used.

AMYGDALUS PERSICA.—PEACH TREE.

The leaves, bark of twigs, and kernels of the *Amygdalus Persica*, Linné. (*Persica vulgaris*, De Candolle).

Nat. Ord.—Rosaceæ.

Common Name: *Peach tree.*

Botanical Source.—The common peach tree is a well-known medium-sized tree, with spreading branches and a brown, smooth bark. Its leaves are from 3 to 5 inches long and about one-third as wide, bright-green, smooth, lanceolate, and serrate, with all the serratures acute. They are borne on short petioles with 1 or 2 glands. The flowers are axillary, solitary, subsessile, and of a beautiful rose-color, and have the odor of hydrocyanic acid. The petals are 5 in number, and the stamens 25. The fruit is a sub-globular, fleshy, tomentose, yellowish-drupe, tinged with purple, and contains an ovate, compressed, acute, stony putamen which is rugosely grooved and perforated on the surface. The seed enclosed by the putamen resembles the almond in odor, taste, and appearance (W.).

Description.—The leaves are lanceolate, finely serrate, from 3 to 5 inches long, smooth on both sides, short petiolate, and green in color. They have a bitter taste and faint odor of hydrocyanic acid. The seeds, though smaller, resemble almonds, chemically and physically.

History and Chemical Composition.—The peach tree is commonly considered to be a native of Persia. It is cultivated in all parts of the United States, where its fruit reaches a greater degree of completion and excellence than in any other country. Its height is from 8 to 15 feet, its fruit is large, being from 1 to 3 inches in diameter, juicy, containing sugar, malic acid, etc., and of a delicious flavor. There are about 200 varieties of this fruit, of which probably one-third are *clingstones*, the flesh adhering to the stone, and the remainder *freestones*, or *clearstones*, the flesh free or separating from the stone. The kernels somewhat resemble bitter almonds, but are smaller, and, probably, possess similar medicinal virtues. They contain *amygdalin*. Hydrocyanic acid can be obtained from most all parts of the tree. Gmelin procured by distillation of the leaves a yellow volatile oil which was heavier than water, and contained hydrocyanic acid. The fixed oil of the seeds is used to adulterate oil of almond, which it resembles. It is known as "*peach oil*." A liquor known as *peach brandy* is distilled from the fermented fruit.

Action, Medical Uses, and Dosage.—Peach leaves in infusion have been recommended in morbid *irritability of the bladder and urethra*, *pertussis*, *ischuria*, *hematuria*, and *nausea*, as well as in all *inflammations of the stomach and abdomen*. They act as a sedative in doses of a tablespoonful every hour or two, of the cold infusion; in larger doses they slightly act upon the bowels, and are said to have been useful in removing *worms*. Amygdalus is *the* remedy for irritation and congestion of the gastric surfaces. It is a very valuable agent in *gastritis* to control the vomiting and allay the extreme irritability of the stomach. *Cough* depending upon irritation of the throat and bronchial mucous membranes, is amenable to it. Prof. J. M. Scudder has found the infusion useful in *gastro-intestinal irritation*, in *cholera infantum* with nausea or vomiting, in *chronic diarrhœa* and *dysentery*, in *chronic hepatitis*, in *chronic bronchitis*, and in *dyspepsia* attended with gastralgia and nausea. The cold infusion may be freely administered. The kernels are similarly employed in the form of tincture, infusion, or syrup; 4 ounces of the kernels in a quart of brandy is asserted to form a powerful tonic in *intermittent fever*, and to be remarkably efficacious in curing *leucorrhœa*; dose, a teaspoonful 3 or 4 times a day. Both leaves and kernels give hydrocyanic acid, with emulsin. Poisoning like that from hydrocyanic acid has occurred from the ingestion of peach seed. Infusion (℥ss of bark of twigs and leaves to water Oj), 1 fluid drachm to 1 fluid ounce. Specific amygdalus, 1 to 10 drops.

Specific Indications and Uses.—Gastric and abdominal tenderness, irritation, or congestion, with elongated, pointed tongue with reddened tips and edges, and prominent papillæ, nausea and vomiting; intestinal and bronchial irritation, irritative cough; irritative diarrhœa.

Related Species.—*Eriobotrya japonica. Loquat.* The leaves and seeds of this tree contain emulsin and amygdalin in amounts sufficient to produce toxic quantities of hydrocyanic acid (*P. J. Trans.*, 1885).

Heteromeles arbutifolia. Toyon. California. Contains hydrocyanic, tannic, and gallic acids. (D. D. Lustig, *A. J. P.*, 1882).

AMYL NITRIS (U. S. P.)—AMYL NITRITE.

FORMULA: $C_5H_{11}NO_2$. MOLECULAR WEIGHT: 116.78.

SYNONYMS: *Amyl-nitrous ether*, *Amylæther nitrosus*.

"A liquid containing about 80 per cent of amyl (principally iso-amyl), nitrite [$C_5H_{11}NO_2=116.78$], together with variable quantities of undetermined compounds. It should be kept in small, dark, amber-colored and glass-stoppered vials, in a cool and dark place, remote from lights or fire"—(*U. S. P.*).

Source and History.—Nitrite of amyl was discovered by M. Balard, in 1844, who gave an account of its chemical and physical properties. Chapman and Smith (*Jour. Chem. Soc.*, 1866 and 1867), and afterward Chapman (*Pharm. Jour. and Trans.*, 1871), investigated it carefully. Tanner recommends that it be prepared by a process similar to that of Mr. Redwood for making nitrous ether. Maisch (*Am. Jour. Pharm.*, 1871, p. 147), distills purified amyl alcohol with nitric acid. In all cases the operation requires the utmost care and attention, notwithstanding which by-products will be largely produced which will require careful elimination.

Preparation.—The process of Prof. Maisch, as modified by him from Balard's, is essentially as follows: Mix pure amyl alcohol with its bulk of nitric acid in a rather large glass retort and heat gradually until the reaction commences, then remove the fire and allow the subsequent spontaneous distillation to proceed until the temperature reaches 100° C. (212° F.). This distillate only is reserved, as above that temperature considerable nitrate of amyl, and ethyl-amylic ether are produced. The reserved distillate is agitated with solution of caustic potash in order to remove free acids. The decanted liquid is carefully distilled, and those portions only that distill between the temperatures 96° C. (205° F.), and 100° C. (212° F.), are to be reserved. The yield is small.

Tanner mixes 10 parts of amyl alcohol with 1 of sulphuric acid in a capacious glass retort containing some copper wire; 1 part of nitric acid is added, having been previously diluted with its volume of water. Heat is now applied, and distillation conducted until a temperature of 98° C. (208° F.), is reached; the heat is then discontinued, and when the temperature of the liquid within the retort has fallen considerably, another part of nitric acid is added through a safety funnel, and distillation conducted as before. The operation is repeated until the distillate rather more than equals the bulk of the amyl alcohol employed. This constitutes impure nitrite of amyl, and may be purified by the directions given in Prof. Maisch's process.

Description and Tests.—"A clear, yellow or pale-yellow liquid, of a peculiar, ethereal, fruity odor, and a pungent, aromatic taste. Specific gravity, 0.870 to 0.880 at 15° C. (59° F.). Almost insoluble in water; miscible, in all proportions, with alcohol or ether. In alcoholic solution it gradually decomposes with formation of ethyl nitrite and amylic alcohol. It is very volatile, even at a low temperature, and is inflammable, burning with a fawn-colored flame. At about 96° to 99° C. (204.8° to 210.2° F.), it boils, yielding an orange-colored vapor"—

(*U. S. P.*). When much diluted with ether and allowed to act upon sodium in excess, almost pure nitrogen is produced. If the *nitrite* be in large excess, monoxide of nitrogen (N_2O), is evolved. It is converted by the oxidizing action of chromic acid into nitric acid, valerianic acid, and valerianate of amyl (Chapman and Smith).

"If 1 Cc. of normal potassium hydrate V.S. and 10 Cc. of water be mixed with 1 drop of phenolphtalein T.S., then 5 Cc. of amyl nitrite added, and the tube inverted a few times, the red tint of the alkaline layer should still be perceptible (limit of free acid). On shaking together equal volumes of amyl nitrite and potassium hydrate T.S., the aqueous layer should not acquire a deeper tint than pale-yellow (limit of aldehyde). Amyl nitrite should remain transparent, or nearly so, when exposed to the temperature of melting ice (absence of water). If 0.26 Gm. of amyl nitrite, diluted with about 5 Cc. of alcohol, be introduced into a nitrometer, followed by 10 Cc. of potassium iodide T.S., and afterward by 10 Cc. of normal sulphuric acid V.S., the volume of nitric oxide generated, measured at the ordinary indoor temperature (assumed to be at or near 25° C., or 77° F.), should be about 40 Cc. (each cubic centimeter indicating about 2 per cent of pure amyl nitrite)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Nitrite of amyl was introduced to the profession as an anæsthetic, in 1863, by Dr. B. W. Richardson, of England; but from many experiments that have subsequently been made, it appears that unconsciousness does not follow its inhalation until its full effects have been experienced, and these effects are due to its absorption by the various tissues of the system. The blood becomes blackish or of a chocolate color, and the absorption of oxygen, as well as the production of carbonic acid, are greatly lessened; and, after a time, from its continuous action, the blood presents a modification appreciable with the spectroscope, and the hemoglobin loses its faculty of crystallizing. From its action vascular and mucous tissues present a dark appearance, the number of pulsations diminish and then increase, the capillaries dilate, arterial tension becomes greatly lessened, and the temperature decreases. Bader and Goodhart, at Guy's Hospital, found that 3 drops of the nitrite, on sugar, occasioned considerable dilatation of the retinal veins, and especially of the papilla of the optic nerve, so as to leave no doubt as to the production of a cerebral hyperemia. Nitrite of amyl likewise possesses a paralyzing influence on both nerves and muscles. Its effects, however, do not appear to be the same with all who inhale it; some are affected by a very minute amount of it, while others require large doses for inhalation, even to 40 drops. With some its action is succeeded by nausea; others, again, will have their vision dimmed, or will be annoyed by a yellow cloud in the field of vision, yellowish and green sparks or rings, and persons around them will appear to be surrounded with a yellow or dark tint. Occasionally, its inhalation is followed by pallor, great depression, and collapse. On these accounts, great care and prudence must be observed in its administration, and especially on the first occasion of its inhalation. With some, repetition of the inhalation appears to lessen its more serious effects; but a too prolonged inhalation should always be avoided, as it is apt to prove fatal. It should not be employed in serious organic diseases of the heart or of the brain.

The usual immediate effects from inhalation of the nitrite of amyl are those observed at first by Guthrie, viz., flushing of the face, throbbing of the carotids, and acceleration of the heart's action. Some patients, after its administration, complain of throbbing in the temples, fluttering of the heart, and a death-like sensation of breathlessness; others feel a tingling throughout the system, or cramp-like pains in the extremities. Dr. Richardson, who introduced nitrite of amyl as a remedial agent, considers its physiological action to be directly exerted upon the ganglionic nervous tract; that it paralyzes so that the nervous supply over the extreme vascular system is impaired; that this paralysis of the nerves travels from the periphery inwards, diminishes muscular contractility, followed by relaxation and dilatation of the capillaries. This effect of the article led Dr. Richardson to suggest it primarily as a remedy for excessive spasmodic action, as in *tetanus*, *angina pectoris*, etc., in which affections it has proved very successful. The action of the nitrite is curative only so far as it controls the spasms present —that is, it prevents death, and thus allows time for recovery, either from the natural powers of the patient's system, or from the employment of the proper hygienical and therapeutical measures. The various maladies in which it has been successfully employed, are, *angina pectoris*, for which it is the best known palliative, *tetanus*, uncomplicated *neuralgia*, *spasmodic asthma* depending more upon nervous derangement than upon organic lesions, *spasms* of the fibers of involuntary muscles, as in *intestinal colic*, *epilepsy*, *hystero-epilepsy*, *nervous headache*, due to anemia, in which it acts promptly, *chorea*, *syncope*, *puerperal convulsions*, *spasmodic pains* in some of the more important organs of the trunk, *trismus nascentium*, and *intermittent fever*. While its inhalation may cure certain of these affections, it must be borne in mind, that, with many of them, a very prompt and material amelioration of the troublesome or painful symptoms are all that can be expected, as in *epilepsy*, *eclampsia*, *hysteria*, etc. In the *sick-headache*, and other disorders of the menopause, as flushes of heat followed by perspiration, cardiac palpitation, and great prostration. ℞ Amyl nitrite gtt. xv, alcohol fl℥j. Mix. Dose, from 1 to 10 drops on sugar, 3 times a day. Amyl nitrite is a good drug in *cardiac dyspnœa* from hypertrophy or *anasarca*. In obstinate *whooping-cough* it gives temporary relief. *After-pains* are said to be promptly checked by its inhalation. Dr. W. E. Saunders (Scudder's *Spec. Med.*, 72), cuts short attacks of *ague* by the inhalation of 2 drops of amyl nitrite or 4 drops of a mixture of equal parts of amyl nitrite and oil of coriander. The inhalation is discontinued as flushing of the face and warmth take place. *Strychnine poisoning* is said to be antidoted by it, used to control the convulsive action.

Chloroform contracts the capillary vascular system, and in several serious cases of *narcosis* following the inhalation of chloroform, the prompt employment of the nitrite of amyl as an antagonizing agent has been successfully resorted to. In *seasickness*, the nitrite has been used with much efficiency. It has likewise been advised in the collapsed stage of *cholera*, by Gamgee and others, but Dr. Brunton has stated, from a doubt whether it dilates the pulmonary capillaries, which are contracted in this disease, that he considers it should be used, if at all, in this disease, either internally or by subcutaneous injection, and not by inhalation; also in *spasmodic asthma*, when the arterialization of the blood is impaired.

In the employment of nitrite of amyl, it is highly important that a pure article be had. When used in inhalation the dose is from 2 to 5 drops, which are to be placed upon a folded linen or handkerchief, and then immediately inhaled for from 3 to 6 minutes. The article is also put up by manufacturers in hermetically sealed glass tears, and called "pearls of nitrite of amyl." As the fluid is exceedingly volatile, this is undoubtedly the best form in which to keep it; and these pearls can be had, each one containing 2, 3, or 5 drops; all that is necessary being to place the pearl in the center of the handkerchief, then crush it, and inhale the vapor. Internally it is rarely employed in doses of from 2 to 5 drops in a small amount of spirit; thus used, its action is very energetic and requires to be closely watched. In *poisoning by chloroform* and in the *collapse of cholera*, 2 or 3 drops may be subcutaneously injected.

Specific Indications and Uses.—Tensive spasmodic disorders of the heart, as in angina pectoris; fluttering, irregular pulse; cold and pallid surface; depression; nervous spasms; nervous headache with pallor; dyspnœa from cardiac hypertrophy. In very minute doses in increased throbbing of the arteries; in flushing of the surface, and in burning pain with natural hue of the skin. *Contraindicated* by tendency to apoplexy, brittle or atheromatous arteries, and in predisposition to blood-determination to the brain.

Related Compound.—AMYL NITRAS ($C_5H_{11}NO_3$). *Amyl nitrate.* Specific gravity, 0.902 at 15° C. (59° F.). Boiling point near 147° C. (296.6 F.). This compound is prepared by acting upon amyl alcohol (50 parts by measure), with 150 parts of a mixture of nitric acid (1) and sulphuric acid (2). The amyl alcohol is to be dropped through a tube of considerable length and the mixture accomplished by continuous stirring. The whole is kept cold by a mixture of salt and ice. Impure amyl nitrate rises to the surface as an oily stratum, and is subsequently purified by washing with weak caustic potash solution and water, drying by means of chloride of calcium, and finally rectifying the product. It forms a sweet, oily fluid, without color, and possessing a characteristic odor, and pungent taste. It is insoluble in water, but dissolves in the three alcohols (ethylic, amylic, and methylic), in benzene and glacial acetic acid. It is not used in medicine, and should not be confounded with *nitrite of amyl.*

AMYLENUM. AMYLENE.

FORMULA: C_5H_{10}. MOLECULAR WEIGHT: 69.85.
SYNONYMS: *Isopentene*, *Pentene*, *Valerene*

Source and History.—Amylene was discovered by Balard, in 1844, who obtained it by distilling amyl alcohol with zinc chloride. It was introduced to the medical profession by Dr. Snow, in a paper presented to the Medical Society of London, January 10, 1857. In the same year, M. Duroy experimented with it carefully, obtaining but 1¼ ounces of amylene from 10 pints of amyl alcohol. By his and subsequent investigations it was found that commercial amylene is not a pure article. Its principal constituent is beta-iso-amylene (trimethyl ethylene $[CH_3]_2C:CHCH_3$).

Preparation and Description.—It is prepared by distilling equal parts of amyl alcohol and zinc chloride, by which means amylene and some of its isomers, amyl alcohol, and other substances are obtained. It is to be purified by fractional distillation from chloride of calcium, care being taken that the hydrocarbons of higher boiling point are rejected (see *Pental* below). Amylene is a thin, colorless liquid, having a fragrant odor, being freely soluble in alcohol and ether, and almost wholly insoluble in water. It boils at 35° C. (95° F.), and has the specific gravity 0.663 at 0° C. (32° F.). It burns with a bright, smoky flame. Sulphuric acid, previously diluted with half its bulk of water, causes it to polymerize; of the various bodies thus formed, one only, diamylene ($C_{10}H_{20}$), has been more closely studied. Amylene is also known under the name *isopentene*.

Action and Medical Uses.—Dr. Snow introduced this agent as an anæsthetic, but a large amount of it is lost during inhalation, from not being absorbed, besides, death has occurred very suddenly from its use. Unlike the commonly employed anæsthetics, it often produces complete anæsthesia before loss of consciousness, and does not readily nauseate. The French Academy of Medicine gave it a very careful investigation, and rejected it as an uncertain and hazardous agent. It has, therefore, not come into general use, as few physicians would care to replace chloroform or ether by so unsatisfactory an article.

Related Compounds.—PENTAL. *Beta-iso-amylene*, *Trimethylene* ($[CH_3]_2C:CH.CH_3$). Density 0.678. Boils at 38° C. (100.4° F.) This highly inflammable compound is a purified form of amylenum. It is prepared by digesting amylic alcohol with chloride of zinc, and afterwards fractionally distilling the mixture. It is a volatile, colorless fluid, of an odor recalling that of mustard. It is not soluble in water, but dissolves in alcohol, chloroform, and ether. It has been employed as an anæsthetic, requiring but a small amount (less than 6 drachms) to produce insensibility. It is occasionally dangerously depressant to the circulation, and is not likely to come into use, being much less efficient than our commonly employed anæsthetics. It has been employed locally by spray in minor operations.

AMYLENUM HYDRATUM.—*Amylene hydrate*, *Tertiary amylic alcohol*, *Dimethyl-ethylcarbinol* ($C_5H_{12}O=[CH_3]_2COH.C_2H_5$). Molecular Weight: 87.81. Density 0.815 to 0.820. Boiling point near 102.5° C. (216.5° F.). This compound is official in the *German Pharmacopœia*, and is prepared from crude amylene, consisting principally of beta-iso-amylene ($[CH_3]_2C:CH.CH_3$), by shaking it in the cold with sulphuric acid, whereby amyl sulphuric acid is formed, and boiling the latter with water. The product obtained is then subjected to fractional distillation, and that portion of the distillate reserved which distills over between 100° C. (212° F.) and 102.5° C. (216.5° F.).

Amylene hydrate is a volatile, limpid fluid, without color, and possessing a pungent, somewhat camphoraceous, mint-like odor, and a sharp, hot taste. It is neutral to litmus, mixes freely with alcohol, benzin, chloroform, fixed oils, and glycerin, in all amounts, and with water (1 in 8). It should not contain amylic alcohol nor aldehyde. This agent is employed chiefly as a hypnotic. It is of less value in spasmodic disorders. The slumber induced is natural and without stupor, the patient awakening promptly and refreshed, without headache, nor gastro-intestinal disturbances. It is serviceable in the *insomnia of insanity*, and during convalescence from exhausting diseases, and in the *sleeplessness* of old age, or arising from mental overwork, neurasthenia, or alcoholism. From 40 to 75 grains are recommended in red wine, or water flavored with a fruit syrup, or syrup of liquorice. The same amount may be given in mucilage by enema, where organic disease of the stomach prevents its ingestion. Amylene hydrate has also been praised as a remedy in *mania*, *delirium tremens*, the *cough of phthisis* and *whooping-cough*, and in *epilepsy*, especially *petit mal*, and in *nocturnal epilepsy*.

AMYL HYDRIDE (C_5H_{12}).—This product resembles, in some respects, amylene, though its odor is more like that of chloroform, and it has a lower boiling point, 30° C. (86° F.), than the former. It is obtained from petroleum and coal, being found among the more volatile constituents of the former, and in the light, tarry oil of the latter.

AMYLUM (U. S. P.)—STARCH.

"The fecula of the seed of *Zea mays*, Linné" (*U. S. P.*).
Nat. Ord.—Gramineæ.
FORMULA: $C_6H_{10}O_5$. MOLECULAR WEIGHT: 161.62.
SYNONYM: *Corn starch.*
ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 296.

History and Source.—The ancient Greeks were well acquainted with starch, and its preparation "without the use of a millstone" (hence the name, *amylum*). The process is described by Dioscorides, and later by Pliny, and closely resembles in principle that followed in our days. Beccari, in 1745, showed that gluten may be obtained as a by-product when wheat is used as raw material (R. and S).

The pharmacopœial starch is derived from the seed of the *Maize*, or common *Indian corn plant*, for a description of which see *Zea Mays*. Previous to the present revision (1890), the *U. S. P.* recognized the starch prepared from the seeds of *Triticum vulgare*, Villars, or *Common wheat*. Starch belongs to the organic compounds called *carbo-hydrates*, and is one of the principal constituents in various organs of many plants, especially in the seeds, where it serves as stored food-material for the growing embryo; also in roots and tubers (potatoes, arrowroot, tapioca), and in the pith of the stems of certain plants, *e. g.*, the sago palm. It abounds especially in the different kinds of grain, among which wheat yields one of its purest varieties, and from which an average of about from 50 to 60 per cent is to be had.

Preparation.—Commercial starch is principally obtained from potatoes and the more abundant cereals. The processes for preparing the various kinds of starch differ to some extent, though all are prepared by comminution of the starch-bearing parts, then separating the starch from the coarser portions by treating with warm or cold water, and allowing the starch to subside. Most cereal starches are prepared as follows: Soak the grain in luke-warm water, to which has been added a little alkali to separate the starch grains from the gluten. After the outer covering of the grain has softened, the material is ground under water and put into sieves and thoroughly washed, over a tank, with pure cold water. The gluten is thereby left upon the sieve, and the starch passes through and is allowed to subside in the tanks. It is then collected and dried in drying chambers, and is ready for use. Starch may be obtained as follows: From wheat flour, which consists of starch, gluten, mucilage, albumen, salts, and bran. The flour is kneaded in a cloth with successive portions of cold water, whereby the gluten and bran remain in the cloth; the mucilage, albumen, and salts dissolve in the water, and the starch passing away with the water, in a state of suspension, gradually falls to the bottom. By allowing the albumino-mucilaginous water, from which it has subsided, to undergo fermentation, the starch is thereby purified from all of the gluten; for the acetic and lactic acids formed during this process dissolve the gluten. The fermentation method is sometimes carried out directly with the wheat, after the latter is softened with water and crushed in roller-mills. The fermented mass is then washed in sacks and fine sieves, as before described. Another method, by which no fermentation takes place, and the gluten may nearly all be saved, is as follows: Allow a stiff dough of wheat flour to stand for a few hours, and then transfer it to a fine wire sieve. While a small stream of cold water plays upon it, knead it until the latter passes clear. The starch may now be thoroughly washed with cold water, drained, and dried. The gluten remains upon the sieve to the extent of 25 parts from 100 parts of wheat flour.

Description and Properties.—Starch, from whatever source, occurs in the form of white granules of varied size and form; these granules are definitely organized structures, although their existence in relation to that of the cell is transitory. They are the first definitely-formed products of assimilation, insoluble in the ordinary cell-sap of the plants containing them, through a process of organization analogous to that by which the development of the cell itself is effected. When these minute granules acquire appreciable dimensions, concentric lines may be observed, more or less distinctly in different cases; a well-marked example is offered in the granules of the potato-starch. These lines increase in number with the increase of size, in many cases, however, soon becoming eccentrical from the preponderating growth of one side of the granule. In freshly extracted granules, the original center generally appears solid, or with a minute black point; but if the starch is dry, the center appears hollow, sometimes is even occupied by air, and some starch grains have a large cavity. If strong alcohol be applied to fresh grains, the abstraction of water likewise produces a hollow in the central point of growth, and in all these cases, cracks not infrequently run out toward the surface. The lines seen in the starch granules are the boundaries of concentric superimposed layers of its substance; sometimes these are very distinct, sometimes very faint; often, more distinct lines appear at intervals in the series of the same granule, and in these cases even, a thin vacancy, or in the dried granules a stratum of air, seems to exist between the layers. The specific gravity of starch is 1.53; its chemical composition is $C_6H_{10}O_5$, or a multiple of this formula.

Starch, according to the *U. S. P.*, made from corn occurs "in irregular, angular masses, which are easily reduced to a fine powder; white, inodorous, and tasteless; insoluble in ether, alcohol, or cold water. Under the microscope appearing as granules, nearly uniform in size, more or less angular in outline, with indistinct striæ, and with a distinct hilum near the center. Triturated with cold water, it gives neither an acid nor an alkaline reaction with litmus paper. When boiled with water, it yields a white jelly having a bluish tinge, which, when cool, acquires a deep-blue color on the addition of iodine T.S. When completely incinerated, starch should leave not more than 1 per cent of ash"—(*U. S. P.*).

Starch, as met with in commerce, is of a granular appearance, friable, insipid, inodorous, permanent in dry air, and in the form of irregular quadrangular or hexagonal columns, emitting a peculiar sound when compressed. In a damp atmosphere it absorbs about 24 per cent of water, without losing its dry appearance; a moderate heat removes its moisture. In its ordinary state it contains about from 12 to 18 per cent of moisture. Starch, well dried by heat, produces with water a rise in temperature of about 15° C. (27° F.) [Mærcker].

Following the researches of Naegeli and others, it is now generally adopted that the starch granules consist of three constituent bodies: An external, thin tegument, of the nature of cellulose, not soluble in water, and not attacked by sugar-forming ferments; to the presence of this protecting influence the fact is due that cold water has no action whatever on starch granules as long as they are not crushed. This tegument envelops another substance called *starch cellulose* proper, or *farinose* (formerly named *amylin*), which in turn encloses the bulk of the starch granule, a substance called *starch granulose* (formerly termed *amiden*), soluble in hot water, insoluble in alcohol and ether. The solution of the latter substance in water is powerfully dextro-rotatory, three times as much as cane sugar (Biot). There is, probably, no essential difference between starch cellulose and granulose. The former, under the influence of sugar-forming ferments (ptyaline, contained in saliva, and diastase), may be converted into the same substances as granulose; at ordinary temperature the conversion of starch cellulose takes place very slowly, with the result that it may thus be differentiated from the granulose. In pure condition it is colored yellow by iodine solution.

Warm water at about 87.7° C. (190° F.) converts starch into a kind of mucilage, which, when sufficiently concentrated forms, on cooling, a jelly, *starch paste*. When long boiled, the granule almost wholly dissolves, and the decoction on cooling does not gelatinize. Alcohol removes from potato starch a trace of essential oil, on which its odor and taste, when any is present, depend. Pure starch is colored blue by iodine, whether in its natural state or softened by hot water, the depth of the color depending upon the quantity of iodine. Where much is added, the color is almost black. The best application is the solution of iodine in iodide of potassium, and this should be used very weak in the investigation of starch If iodine be almost a million times diluted, it can be detected by starch. Iodide of starch, when suspended in water and heated nearly to the boiling point, loses its blue color, which returns as it cools; alkalies also remove the blue color; alcohol has the same effect. Boiling with diluted sulphuric acid, also hydrochloric or oxalic acids, converts starch paste into sugar (dextrose) yielding several intermediary and soluble products collectively called *dextrin.* The latter products are colored yellow or red, not blue, by iodine solution, and the process may thus be traced by the iodine reaction. Dextrin may also be formed by subjecting starch to a temperature of about 204.4° C. (400° F.) (see *Dextrinum*). Starch may be converted for the most part into sugar (maltose) by the ferment *diastase*, a substance into which the protein matter of barley and other grains is converted, after these have been made to germinate, and their vitality destroyed by drying at an elevated temperature; as an intermediary product, *dextrin* (malto-dextrin) is formed. One part of diastase can convert 2000 parts of starch, at 65° C. (149° F.), into dextrin, and a little sugar, or maltose. The dextrin is completely convertible into sugar only by continued boiling with diluted mineral acids. Starch is dissolved by alkalies, from which it is again precipitated by acids, acetate of lead, tannic acid, calcium and barium hydroxides. Upon the formation of an insoluble compound of starch with barium hydroxide is based a method for the quantitative determination of starch, devised by Asboth. When heated, starch melts, turns black, and is decomposed. Nitric acid splits it into malic and oxalic acids. With fuming nitric acid, starch is changed into a white powder, capable of being softened by water, but not soluble in it. It is also insoluble in alcohol. This tasteless powder is a mixture of certain nitrates of starch, called *xyloidin*, an explosive substance discovered by Braconnot (R. and S.).

Action and Medical Uses.—As a constituent of many vegetable substances, starch forms a most important alimentary substance; in a medical point of view, it is to be considered as a demulcent. The powder of starch is used to take up acrid secretions from the external surface, soothe the pain in *erysipelas*, and to prevent *intertrigo* in children; in these affections it is usually dusted on the parts. It is also used in mucilage, or in emulsion for suspending drugs, when to be given internally, or by injection, especially as a lenitive in *inflammation of the lower bowel.* Starch is sometimes triturated with the more active medicines, in order to render them more bulky and easily taken. It is an *antidote to iodine* when swallowed in large quantity.

Other Varieties of Starch.—I. Amylum Tritici, *Wheat-starch.* The fecula of the seeds of *Triticum vulgare*, Villars (*Triticam sativum*, Lamarck). *Nat. Ord.*—Gramineæ. This starch was formerly official in the *U. S. P.*, but has been replaced by corn-starch. According to Pereira, wheat-starch, examined under the microscope, consists of large and small grains, the large ones being rounded and flattened, or lenticular; the small ones rather spheroidal. In the middle of the flattened surface is the rounded, elongated, or slit *hilum*, surrounded by concentric rings, which frequently extend to the edge of the grains. When heated, the particles crack at the edges. The grains vary in size from .0001 to .0009 of an English inch. These granules have each a thin exterior pellicle or tegument, insoluble in water, and an interior soluble substance (see *Farina Tritici*).

II. Amylum Oryza, *Rice-starch*, *Rice-flour.* Prepared from the seeds of *Oryza sativa*, Linné (*Nat. Ord.*—Gramineæ), or ordinary *Rice.* The latter is deprived of its coverings and palæ, and presents a pearly-white, or translucent, oblong body, about $\frac{1}{8}$ inch in length, with a single groove on one side. Rice starch presents the smallest granules of all the ordinary commercial starches. They consist of polygonal grains more or less adherent to other or larger granules. The rice plant is largely cultivated in subtropical and tropical regions, and quite largely in Southern United States. Its native habitat is India (see *Oryza sativa*).

III. Amylum Solani, *Potato-starch.* The common potato plant is too well known to need a description. It is indigenous to Chili and Peru, and was cultivated at an early date in Virginia from whence the colonists carried it to England. Potato-starch is the principal starch of commerce, and is very largely employed, and is even used to adulterate other varieties, notably arrowroot. It consists of large, irregularly-oval granules intermixed with small subspherical ones. The larger ones present a small hilum at the little extremity and are marked by distinctly concentric lines, giving under the microscope the appearance of a sea-shell.

IV. Amylum Cannæ.—*Canna, Canna starch.* Probably the fecula of the root of *Canna edulis*, Ker. *Nat. Ord.* Marantaceæ.

Canna starch, also known as "*Tous les Mois,*" is obtained from a West Indian plant, supposed to be the *Canna edulis* of Ker, the tubers or roots of which are rasped, and then subjected to the ordinary methods of washing, straining, decantation of the supernatant fluid, and drying of the deposited starch. Canna starch is imported from St. Kitts, and is an excellent form of arrowroot. Canna starch looks more like potato-starch than any other amylaceous substance, has a satiny or glistening exterior, and its particles are large, varying in length from the $\frac{1}{150}$ to the $\frac{1}{400}$ of an inch. Examined by the compound microscope, they are oval or oblong, generally more or less ovate, have a very distinct nucleus or hilum, and fine, regular, uniform, concentric rings. The circular hilum is usually placed at the narrow extremity, and is very rarely double. The hilum and the body of the particle are frequently cracked. *Tous les Mois* contains about 16.74 per cent of hygroscopic water, is very soluble in boiling water, and yields a very tenacious jelly when boiled in this fluid. Canna starch forms a salutary and agreeable article of diet for invalids and children, and appears to be easily digested. It may be boiled the same as arrowroot, and used in the same cases. By many it is preferred to any other kind of arrowroot.

V. AMYLUM MANIHOT, *Tapioca*.—(See *Manihot*).

VI. AMYLUM MARANTÆ, *Arrowroot*.—(See *Maranta*).

VII. SAGO.—(See *Sago*).

Starch Derivative and Preparation.—DEXTRIN, *Dextrinum* ($C_6H_{10}O_5$). This derivative of starch may be prepared in several ways. On a large scale it is usually prepared by heating starch to a temperature ranging from 226° to 260° C. (438° to 500° F.). It is a whitish-yellow or yellowish, non-crystalline, gum-like mass, or it may occur in granular form, insoluble in ether and alcohol, but readily soluble in water. Its action on polarized light is dextrogyrate, and with an alkaline copper solution occasions no reaction. *White dextrin* has the appearance of starch. It forms a very tenacious, adhesive paste with water, which does not cause the paper on which it is spread, to wrinkle, as do many adhesive mixtures.

AMYLUM IODATUM, *Iodized starch*, *Amyli iodidum*, *Iodide of starch*, *Ioduretum amyli*.—This compound was official in the *U. S. P.* of 1880, which directed iodine (5 parts) to be triturated with a small quantity of distilled water, and starch (95 parts) to be gradually added, and the trituration continued until a uniform blue (approaching black) coloration ensued. It was finally to be dried at a heat not higher than 40° C. (104° F.), and after rubbing to a finely powdered state, kept in closely secured, glass-stoppered vials. This product is by some thought to be a definite chemical compound, Payen and Fritzsche giving it the formula $(C_6H_{10}O_5)_1I$, and Bondonneau $(C_6H_{10}O_5)_5I$. Although it is generally believed to be what Liebig pronounced it, a mixture of finely comminuted iodine and starch, the fact must not be overlooked that iodide of starch may be subjected to a temperature of 100° C. (212° F.) for 6 to 7 days without any loss of iodine being incurred (Stokes in Maercker's *Handbuch*).

Iodized starch is a deep-blue powder, decolorizing in the sunlight. It has a slight odor of iodine. Water heated above 65° C. (149° F.) also decolorizes it, but it again assumes its blue color on cooling. Iodine is partly expelled by boiling with water, and may be wholly driven off by long-continued boiling. Such substances as will readily dissolve iodine, as caustic potash, alcohol, sulphide of hydrogen, and nearly all animal fluids decompose it. The production of iodized starch exhibits the action of the best known test for iodine. The nearer the freezing point, the more perfect are the results of this test. The test is exceedingly sensitive (see *Amylum*). This compound was introduced into medicine as a non-irritating preparation of iodine. Buchanan, of Glasgow, who advocated its use, gave large amounts of it in the course of 24 hours without ill effects. It forms insoluble compounds with many *poisons*, consequently Bellini recommended it as a general antidote, and further claimed that it assists in the elimination of lead, mercury, and other salts, in cases of poisoning by them. It has been given with success for *lupus erythematodes* (McCall Anderson). A well-rounded teaspoonful may be administered several times throughout the day. As high as 3 ounces have been given in a day, administered in three doses (Buchanan).

ANACARDIUM—CASHEW-NUT.

The nut of *Anacardium occidentale*, Linné (*Cassuvium pomiferum*, Lamarck).

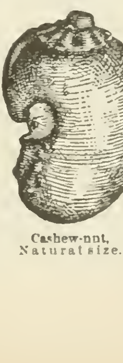
Nat. Ord.—Anacardiaceæ, Lindley (Terebinthaceæ, Kunth).

COMMON NAME: *Cashew-nut*.

ILLUSTRATION: Strong's *American Flora*, p. 125.

Botanical Source and Description.—The cashew-nut is a small tree, native of the East and West Indies and South America. The leaves are alternate, simple, entire, obtuse, and borne on short leaf-stalks. The flowers are very numerous, small, and fragrant; they are produced in terminal, loose panicles. What is known as the "cashew-apple" is the enlarged juicy peduncle which bears the nut. When ripe, it is of a golden-yellow color, obovate in shape, and has a pleasant, acid flavor, but is somewhat astringent. It is much eaten by the natives. The cashew-nut is attached and hangs from the end of the cashew-apple. It is kidney-shaped, and about 1 inch long. It consists of an edible kernel, surrounded by two shells. The outer shell is smooth and of a bright-brown color. Between the two shells there is a very caustic oily substance which produces troublesome sores within the mouths of those who injudiciously attempt to crush the nut between the teeth, in order to obtain the kernel. When fresh, the kernel is pleasant to the taste,

Fig. 20.



Cashew-nut, Natural size.

and is largely consumed by the natives. Fig. 20 is a drawing, natural size, of cashew-nut in our possession.

Chemical Composition and History.—The cashew-nut was first examined by Cadet, who found in it gallic acid and an acrid resin. Afterward, De Mattos (*Jour. de Pharm.*, 1831), by a more careful investigation, found, in addition, tannin, an extractive substance, a gum-resin, and some green coloring matter. But the most interesting investigation was made by Stædeler, in 1847–1848 (*Chem. Gazette*, Vol. VI), who examined the viscid liquid contained between the two shells of the nut, having extracted it by means of ether. This liquid is fluid at 15.5° C. (60° F.), congeals at 10° C. (50° F.), is soluble in alcohol and ether, but insoluble in water, and is acrid and caustic; when placed upon the skin, it promptly produces vesication. Stædeler separated this liquid into two constituents, one of which was an oily substance constituting about 10 per cent, fluid at even low temperatures, and forming the vesicating part of the liquid, which he named *cardol* ($C_{21}H_{30}O_2$). This was associated with an acid substance, white and crystalline, when pure, capable of forming salts with bases, some being crystalline, and others amorphous, and to which Stædeler gave the name *anacardic acid*. This acid is not vesicating. Cardol was recently investigated by Spiegel and Dobrin (1895), who established therefor the formula $C_{32}H_{50}O_3.H_2O$. The tree furnishes a gum in abundance (*gomme d'acajou*, Fr.), which is brittle, and transparent, resembling gum acacia, with the exception of a slight astringency which it possesses. When the trunks of the trees are tapped, a milky juice exudes, which is white when fresh, but turns black on exposure, and, in India, is used as varnish. It stains cotton or linen deep-black by exposure to air. The apple yields a liquor by fermentation, called "cashew wine," which is said to be a wholesome drink. The roasted nuts are edible, care being taken, however, that the fumes from the roasting shell do not come into contact with the face, as thereby painful blisters will be produced upon the exposed portions. A tar is said to be prepared from the pericarp which is used in tarring wood-work and boats, to protect them from the ravages of insects, and the gum from the stems is employed by American bookbinders to insure the bindings from destruction by worms and book-pests.

Action, Medical Uses, and Dosage.—The fresh juice of the rind is very acrid and corrosive, producing redness, tumefaction, inflammation, and blisters, on which account it has been employed in the West Indies for the removal of *warts*, *corns*, *ringworms*, and as a stimulant to *indolent ulcers*. Blisters formed by its application are apt to be very troublesome and annoying. The kernel, especially when roasted, is edible, having a rather sweet and agreeable flavor. *Cardol* possesses the activity of the juice of the rind, producing vesication, and in the higher animals, when injected hypodermatically, gastric inflammation, with diarrhœa, followed by stupor and paralysis. The bark of the tree was used by Adanson, to cure himself of the peculiar *fever of Senegal;* it has an agreeable taste, does not appear to affect the nervous system, has a favorable influence upon digestion, and is very effective in its action, having conquered the *Senegal fever* in cases in which the largest doses of quinine proved unavailable (*Comptes Rendus*, xxvi, p. 254). Prof. Webster (*Dynam. Therap.*, p. 114) suggests its study in *mental disorders*, and states that it has been successfully used in the *mental weakness*, following acute diseases and sexual abuses, in *loss of memory*, *dementia*, and in *failure of nervous power* in the old. From $\frac{1}{3}$ to $\frac{2}{3}$ of a drop of homœopathic mother tincture in water, 4 or 5 times a day, is suggested as the proper dose.

Related Species.—*Anacardium orientale* (*Semecarpus Anacardium*, Linné filius), *Oriental cashew-nut*, India. The nut has similar properties to the cashew-nut. A brown-black oil having strongly vesicant properties, is derived from the mesocarp of the fruit. Serious eruptions of an eczematous nature follow the vesication produced by it, and bloody alvine discharges and disordered urination have resulted from its application. This nut is the *marking-nut* of India. It is there used quite extensively in medicine, being prepared for internal use by boiling it with cow-dung and subsequently washing with cold water. The Hindus use it for *dyspepsia*, *neurasthenia*, *hemorrhoids*, and *cutaneous diseases* (Dymock). The constituents of this nut are probably like those of the cashew-nut, though the brownish oil of the oriental nut differs in giving a green, instead of a red color, in caustic potash solution, and in being precipitated in alcoholic solution, black, instead of red, with basic lead acetate (Basiner, 1881). The nut is described as black, glossy and smooth, about 1 inch in length, subcordate, obtuse, and flattish.

ANAGALLIS ARVENSIS.—RED CHICKWEED.

The leaves of the *Anagallis arvensis*, Linné.

Nat. Ord.—Primulaceæ.

Common Names: *Red pimpernel, Scarlet pimpernel, Red chickweed, Poor man's weather glass.*

Botanical Source.—Anagallis arvensis is a beautiful annual trailing plant, growing in fields, roadsides, etc., introduced into this country from Europe. The stem, which is square, and more or less procumbent, is from 6 to 20 inches long, has elongated branches, or is simple, often dotted with purple. The leaves are sessile, ovate, many-ribbed, opposite or ternate, dotted with purple at the back; the peduncles longer than the leaves; the sepals linear-lanceolate, about equaling the petals; the petals obovate, obtuse, longer than the stamens, and crenate-glandular. The flowers are opposite, small, but beautiful, with scarlet petals opening at 8 o'clock, a. m., and closing at 2 p. m.; in damp weather not open at all. The stamens are purple, hairy, dilated and smooth at the base. Anthers yellow and heart-shaped. Style purple and permanent. Stigma capitate. The capsule is pale and transparent, the size of a pea, separating all round, the valves marked with some indications of longitudinal separations which seldom take effect. The seeds are roughish, abrupt externally, each with a central dot.

History and Chemical Composition.—Red chickweed blossoms from May to August. The leaves are the parts used; they are odorless, but have a rough unsavory taste. Water extracts their virtues. A volatile oil, of the specific gravity 0.980, has been obtained from the dry plant. It has a harsh, pungent taste, and possesses a pronounced odor. Saladin, in 1830, announced that the unpleasant acrid bitterness of the leaves was due to *cyclamin*, a white, poisonous, crystalline principle, while Malapert, in 1857, believed it due to *saponin*. In fact the plant here under consideration, has been usually substituted in Mexico for Saponaria officinalis. In 1891, Dr. Schneegaus obtained two glucosides identical with those from quillaja and senega (*Amer. Jour. Pharm.*). A ferment, active in digesting raw meat, has been found (1892) in it (Daccomo and Tommasi), stated to be a white, amorphous mass, soluble in water, with no action upon starch.

Action, Medical Uses, and Doses.—This plant appears to possess energetic properties, for according to Lindley, Orfila killed a dog by "making him swallow 3 drachms of the extract; upon examination it was found to have inflamed the mucous membrane of the stomach." Grenier obtained a similar result. The volatile oil in very small doses (4 drops) produced bodily pain, and persistent, violent "sick-headache." Its virtues are not fully known. It was considered an *antidote to poison* many years ago, and has more recently been employed to prevent the evil results arising from the *bite* of a rabid animal. Its internal use has been advised in *mania*, *epileptic attacks*, *dropsical affections*, and other derangements of the nervous system, but it should be employed with caution. It may, however, be used in form of poultice, as a local application to old and ill-conditioned *ulcers*. Dose of tincture (℥viij to alcohol, 50 per cent, Oj), from 1 to 5 drops.

Related Species.—*Anagallis cœrulea*, Schreber. *Blue pimpernel.* Distinguished by blue flowers. It was thought by Linné a variety of red pimpernel. Its properties, chemically and medicinally, are probably analogous to those of *Anagallis arvensis.*

ANDIRA.—CABBAGE TREE BARK.

The bark of the *Andira inermis*, Kunth (*Geoffroya inermis*, Swartz; *Geoffroya jamaicensis*, Wright).

Nat. Ord.—Leguminosæ.

Common Name: *Jamaica cabbage tree, Cabbage tree.*

Botanical Source.—The Andira inermis is a tree of moderate height, with terete, glabrous, ash-colored branches, suberect at their extremities. The leaves are alternate, about 1 foot in length, unequally pinnate; with from five to eight paired leaflets on short, roundish, ferruginous, downy stalks, oblong-lanceolate, rarely ovate-lanceolate, acuminate, for the most part rounded at the base; they are entire, glabrous, thin, with the nerves, scarcely prominent, about 4½ inches long and 1 inch broad. The petioles are minutely downy, and the stipules lanceolate and persistent. The panicles are terminal, axillary, and erect; the branches subdivided, spreading, angular, brownish purple, and covered with ferruginous down. The pedicels are very short, one-flowered, numerous, and crowded. The flowers are reddish-lilac. The fruit is a hard, one-seeded legume about the size of a large plum.

History, Description, and Chemical Composition.—This tree inhabits the West Indies, especially Jamaica. The bark, as met with in commerce, is in pieces of various sizes, which are thick, whitish, or grayish-brown externally, covered with scales and eroded by lichens; yellow-brown interiorly; furrowed: of a resinous fracture, nauseous odor, mucilaginous and sweetish taste, and pulverulent, the powder resembling that of jalap. This tree was at one time erroneously supposed to be the plant from which Hüttenschmid, in 1824, obtained his *jamaicine*, that was subsequently (1865) identified as berberin by Gastell. However, Hüttenschmid, in 1824, isolated from the genuine Andira bark a supposed alkaloid, which he called *surinamine*. This was reöbtained by O. Hiller-Bombien, in 1892, from an authentic specimen of Andira inermis, Kunth, and ascertained to be methyl-tyrosin, an amido acid of the formula $C_{10}H_{13}NO_3$, which he found identical with the *ratanhin* of Ruge and the *angelin* of Gintl (1869). He finally named it *andirin*. It occurs in white needles, is tasteless and neutral to litmus, easily soluble in hot water, but sparingly so in cold water, ether, or alcohol. The name *andirin* had been applied before to other, probably more active, constituents of the plant—*e. g.*, by Midy to a glucoside—and Peckolt, in 1859, applied the same name to a brown-yellow coloring matter from Andira anthelmintica, Bentham (see below) (*Amer. Jour. Pharm.*, 1889).

Action, Medical Uses, and Dosage.—Cabbage tree bark is emetic, purgative, and anthelmintic. It is thought by some to be a dangerous acro-narcotic in large doses, causing troublesome sickness, fever, and delirium, on which account it is not much used in practice, although it has proved effectual in removing the *lumbricoid worms*. The bark in powder may be given in doses of from 10 to 30 grains; of the decoction, 1 tablespoonful 2, 3, or 4 times a day. Any unpleasant symptoms resulting from its administration may be obviated by a dose of castor oil, and a free use of lemon juice or lime juice.

Related Species.—*Andira retusa*, Kunth (*Geoffroya retusa*, Lamarck). Habitat, Surinam. Source of Surinam bark. "The Surinam bark has a grayish epidermis, covered with lichens; dark brown, lamellated, very tough, compact; when cut across, brilliant and variegated brown; when recent, nauseous; no smell when dried; taste a little acrid and bitter; powder pale cinnamon." The bark abounds in tannin. It is frequently asserted that Hüttenschmid found his *surinamine* (see Andira inermis) in this bark, but modern researches do not favor this view (E. Schär, 1893, and O. Hiller, 1892).

Andira anthelmintica, Bentham (*Geoffroya vermifuga*, St. Hilaire). Brazil. This tree contains, according to Peckolt, a yellow-brown coloring body, called *andirin*. The seeds of this forest tree are yellow and about the size of nutmegs, and are reputed to possess anthelmintic properties. They are known as *angelim amargosa*. The purgative and vermifuge properties are due to an acrid resinous body, soluble in both alcohol and ether. The sawdust, when inhaled by those who cut the trees down, produces conjunctivitis, great thirst, with faucial constriction, and has a burning, bitter taste. Itching of the integument and occasionally skin eruptions result from it (Peckolt).

Andira Araroba, Aguiar (see *Araroba*).

ANEMONE NEMOROSA.—WIND FLOWER.

The whole plant of *Anemone nemorosa*, Linné.

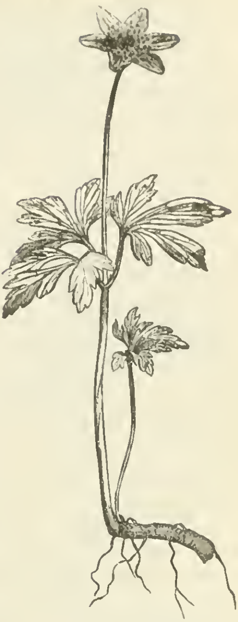
Nat. Ord.—Ranunculaceæ.

COMMON NAMES: *Wind flower*, *Wood anemone*, *Wind crowfoot*.

ILLUSTRATION: *Drugs and Medicines of North America*, by J. U. and C. G. Lloyd, Vol. I, p. 22.

Botanical Source.—"This is a graceful little plant, about 4 inches high, which blossoms in early spring, and is found in open woods. The root is a slender, horizontal root-stalk. The stem, which is produced from the extremity of the root-stalk, is simple, slender, erect, and leafless, except at the top, where it bears a whorl of three-petiolate, three-parted floral leaves, and a solitary, small, peduncled, white, or purplish flower. This little plant is of wide distribution in this country and also in Europe" (C. G. Lloyd, in *Drugs and Medicines of North America*, p. 21).

Fig. 21.

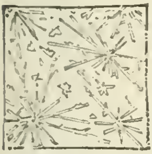


Anemone nemorosa.

History and Chemical Composition.—This plant blossoms in April and May. "*Anemone nemorosa* abounds in an acrid juice, which is particularly intense in the root. These properties disappear when the plant is dried, and hence only the recent plant, or preparations of the recent plant, are of value in medicine. In consequence of this fact, the dried plant is not a commercial drug, and doubtless, like others of this family, the uncertain nature of the plant when dry has prevented it from becoming a recognized remedy" (Prof. J. U. Lloyd, in *Drugs and Medicines of North America*, p. 22).

The acrid properties of this plant are due to a principle subsequently mentioned—a principle that is dissipated even in drying the plant; hence the dried drug is practically inert. According to Prof. J. U. Lloyd (*Drugs and Medicines of North America*, p. 22), a tincture of the fresh plant affords the only reliable representative of the drug. According to Linnæus, it produced in cattle feeding upon the plant both dysentery and bloody urine.

Fig. 22.



Crystals of Anemonin crystallized from chloroformic solutions.

Anemonin ($C_{10}H_8O_4$) Beckurts, 1892), occurs not only in the herbs of *A. nemorosa*, but also of *A. Pulsatilla*, L., *A. pratensis*, L., *Ranunculus reptans*, L., *R. acer*, L. (45 pounds yielded 11.5 Gm.) and *R. sceleratus*, L., and the leaves of *Clematis angustifolia* and *C. integrifolia*. It is obtained by distilling the plants with water, and either setting the product aside, allowing it to crystallize, or shaking out the distillate with chloroform. From this solution *anemonin* first crystallizes, and afterwards a substance called *anemone camphor*, which is a very unstable compound having a sharp odor, irritating the mucous membranes of the nose, etc. It readily splits into *anemonin* and amorphous *isanemonic acid*. To this property of anemone camphor are accredited the evanescent physiological properties of the drug.

Anemonin forms white needles having a fusing point at 150 to 152° C. (302 to 305.6° F.). It is without odor and taste, and of neutral reaction to litmus, but acquires a burning taste when melted. It volatilizes with the vapors of boiling water, and is quite irritating under this condition. It is slightly soluble in cold water and alcohol, more readily in chloroform and fixed oils, but not in ether. Alkalies readily combine with it. *Anemonic acid* ($C_{10}H_{10}O_5$) also occurs in the herb, together with *anemoninic acid* ($C_{10}H_{12}O_6$). The former, occurring in white needles with the fusing point 250° C. (410° F.), may be obtained by boiling anemonin with lead oxide; the latter by warming anemonin with diluted acids (Beckurts, *Amer. Jour. Pharm.*, 1892).

Action, Medical Uses, and Dosage.—This plant is acrid and poisonous. It has been recommended in *amaurosis* and other diseases of the eye, *secondary syphilis*, *cutaneous diseases*, and *whooping-cough*, in doses of 1 or 2 grains daily. These, however, are its old-time uses. When applied locally it is said to be efficient in *scald-head*. In the recent state, the leaves bruised and applied to the skin are rubefacient. In large doses this article produces nausea, vomiting, looseness of the bowels, and hematuria. Prof. Edwin M. Hale, M. D., states that it is not in use among the homœopaths, and that he has heard of several cases of poisoning by it in which the toxic effects were similar to those of pulsatilla, but much more severe. He suggests that as a remedy it might occupy a place between aconite and pulsatilla (*Drugs and Medicines of North America*). Prof. Scudder (*Spec. Med.*) writes: "It influences the functions of waste and repair, but works directly upon the nervous system." The remedy will repay study, and is suggested as of probable value in *skin diseases*, and, we might add, *nervous derangements*. The drug referred to by Webster as "*Pulsatilla Nuttalliana*," or "*Anemone nemorosa*," is undoubtedly *Anemone patens*, var. *nuttalliana*, which see. A tincture of the fresh plant in fruit (℥viij to alcohol Oj) may be tried in doses of a fraction of 1 drop to 5 drops.

Related Species.—*Anemone cylindrica*, Gray. United States. Distinguished by cylindrical fruit-heads. Used by the Indians for the cure of *rattlesnake bite*. Their mode of using it is to chew some of the tops of the plant, swallowing but little of the saliva, and then applying it to the bite; in a few minutes the poison is rendered harmless. When chewed the tops have a hot, pungent taste, somewhat like capsicum. All the anemones are useful in *menstrual suppression*, and all are likewise acrid and poisonous.

Anemone virginiana, Linné. *Wood flower, Wind flower, Thimble weed.* An herb growing from 2 to 3 feet high, having from 2 to 4 greenish-white flowers; distinguished also by its oblong head of wooly achenes. Reputed to have similar properties to those of Anemone nemorosa. According to Kalm, the seeds relieve *toothache* if dipped in alcohol and placed in the tooth cavity. Porcher states that it will remove *corns* (*Drugs and Medicines of North America*, Vol. I).

Anemone patens, var. *Nutalliana* (see *Anemone patens*).

Anemone coronaria, Linné. Levant. Occasionally cultivated. Used medicinally to a slight extent.

Anemone cernua, Thunberg. *White-headed old man.* China and Japan. Root used medicinally.

Anemone sylvestris, Linné. Europe and North Asia. This and the next species employed by the Siberians.

Anemone ranunculoides, Linné. Europe and Siberia.

Anemone pratensis, Linné, and *A. Pulsatilla*, Linné (see *Pulsatilla*).

ANEMONE PATENS.—AMERICAN PULSATILLA.

The flowering plant *Anemone patens*, Linné; *var. Nuttalliana*, Gray. (*Anemone Ludoviciana* Nuttall; *Anemone Nuttalliana*, DeCandolle; *Pulsatilla Nuttalliana*, Sprengel).

Nat. Ord.—Ranunculaceæ.

Common Names: *American pulsatilla*, *Pasque flower*.

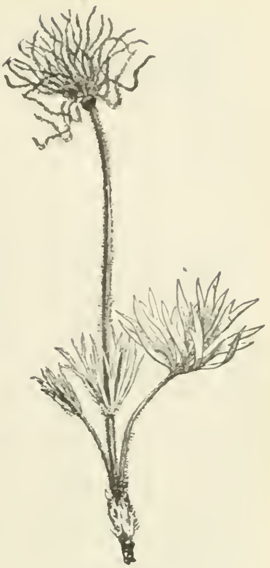
Illustration: *Drugs and Medicines of North America*, by J. U. and C. G. Lloyd, Vol. I, p. 27; Meehan's *Native Flowers*, I, 49.

Botanical Source and History.—"*Anemone patens* is a very conspicuous flower in early spring, found in prairie regions of Illinois, thence west to the Rocky Mountains, and northwest. The stem rises about 4 inches out of the ground, and is terminated by a large, erect, solitary, light bluish-purple flower. Below the flower, encircling the stem, is a many-parted floral leaf, covered with silky hairs, as are all parts of the plant. The true leaves are not expanded at flowering time, but are afterwards developed from the root of the plant, and are palmately divided into many linear lobes. The fruit is a head of achenes, with long, silky tails. It is borne on a stalk which is greatly elongated after the plant has flowered" (C. G. Lloyd, in *Drugs and Medicines of North America*, Vol. I, 26).

The plant has a faint, camphor-like odor, and a somewhat saccharine taste in the dried flowers; the recent flowers and leaves are very acrid and irritating, which properties are considerably lessened by drying, owing to the evaporation of a volatile, acrid principle. The fresh plant will vesicate, and the vapors of the fresh juice have produced severe conjunctivitis. Simple contact with the plant produces severe irritation. The drug was introduced to the profession by Dr. W. H. Miller, and F. B. and A. W. Miller (sons), all of St. Paul, Minn. It was introduced to Dr. Miller by an Indian, who declared it the "great medicine" of the Northwestern tribes of Indians. This plant bids fair to supplant foreign pulsatilla in the American drug market (*Drugs and Medicines of North America*, Vol. I, 28).

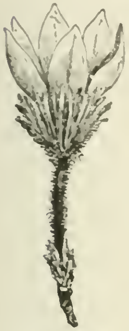
Chemical Composition.—Mr. A. W. Miller (1862), proved the existence of a volatile acrid principle in this plant, and by agitating the aqueous distillate with chloroform he obtained an acrid white principle which he believed to be *anemonin*, though the amount was too small for verification. His brother, Mr. F. B. Miller, re-examined the plant in 1873, and by the same process obtained white, feathery crystals of a neutral reaction at first, but becoming both acid and colored in a few days. A distillate of the fresh juice preserved in alcohol was also distilled by him, and treated with chloroform, from which brown acid crystals were obtained. A quantity of the dried herb was then distilled, and subsequently treated with chloroform, as above, without obtaining the acrid principle yielded by the fresh herb. Hence, it seemed conclusive that the anemonin is dissipated in drying, and this also appears true from the fact that the dried herb has none of the irritating properties of the fresh plant, and upon chewing the herb a year old only a slight tingling sensation was produced. In fact it was scarcely more than astringent. Glucose, tannin, two resins, pectin, calcium and magnesium salts, sulphates, and the ordinary plant constituents were also found by Miller. Albumen was absent (see Prof. J. U. Lloyd, *Drugs and Medicines of North America*, Vol. I, 29). For further details on constituents, see *Anemone nemorosa*.

Fig. 23.



Anemone patens, var. Nuttalliana, with fruit

Fig. 24.



Flower of Anemone patens, var. Nuttalliana.

Action, Medical Uses, and Dosage.—This plant has been found useful in many chronic cases of ophthalmic maladies, as *cataract*, *amaurosis*, and *corneal opacity;* also in *cutaneous eruptions* and *secondary syphilitic diseases*. It has likewise effected cures in uncomplicated *amenorrhœa*, *leucorrhœa*, *pains in the testes*, or *ovaries*, and along the *spermatic chord*, sharp, cutting *gastric pains*, *frontal headache* in onanists, and in *chronic irritation of the nerves*. It will also be found useful in *reflex paralysis*, *obstinate hiccough*, *chorea*, and in *chronic mucous diseases* generally. The foregoing statements constitute a summary of the uses of the drug as gleaned from European and early American observers and are the cases in which large doses were employed. Many of these statements, however, require confirmation. According to Dr. W. H. Miller, it is a good *pile* remedy (*Drugs and Medicines of North America*). Prof. Edwin M. Hale, the distinguished homœopathist, found upon investigation, that its properties were practically identical with those of European pulsatilla. (See *Drugs and Medicines of North America*, for homœopathic uses). This is undoubtedly the drug referred to by Prof. H. T. Webster (*Dynam. Therap.)*, as "*Pulsatilla Nuttalliana*," or "*Anemone nemorosa*." Owing to its probable identity with pulsatilla, this drug will undoubtedly prove a reliable substitute for the European species, and be used for similar purposes and in the same doses (see *Pulsatilla*). The *U. S. P.* (1880), recognized it as a source of pulsatilla. Five to 30 drops of the tincture (℥viij to alcohol Oj), may be added to 4 fluid ounces of water, a dose of which is a teaspoonful 3 times a day.

ANEMONIN. A solution of anemonin has been used externally in *scald-head*, *ulcers*, *caries*, *indurated glands*, *venereal nodes*, *serpiginous affections*, *paralysis*, *amaurosis*, *cataract*, and *opaque cornea*. Its internal use is questionable. It has, however, been employed in *bronchitis* and in *convulsive forms of cough*, as in *whooping-cough* and *asthma*. Experiments upon the lower animals indicate that it possesses paralyzing properties, particularly directed to the cardiac and respiratory functions.

ANEMOPSIS CALIFORNICA.—YERBA MANSA.

The root of *Anemopsis californica*, Hooker.

Nat. Ord.—Saururaceæ.

COMMON NAME: *Yerba mansa.*

Botanical Source and History.—This is a perennial herb, a native of wet places in Southern California and in the northern part of Mexico. The stem is erect, about a foot high, and bears a close, terminal spike of flowers. Near the middle of the stem is borne a large clasping leaf from the axis of which a few short, slender branches are produced. The leaves are mostly in a radical cluster at the base of the stem; they are from 2 to 4 inches in length, one-half as broad, of a firm, leathery texture, smooth and entire; their outline is oblong, with a cordate base. The leaf-stalks are about the length of the leaf, dilated at the base, and pubescent along the margin. The stem is remarkable for sending out from its base, slender, unbranched stolons, from 3 to 6 feet long. These stolons are of rapid growth, and produce at intervals of about a foot, roots and a cluster of leaves, which in another year become a separate plant. The flowers are small, and borne in a thick, dense spike (spadix), about an inch in length. At the base of the spadix are about 6 large, petaloid, involucre leaves in the same manner as the flowering dogwood, which give to the entire inflorescence the appearance of a single terminal flower. The flowers are small, and destitute of either corolla or calyx, but are each subtended by a small colored bract. The stamens are about 6, with short filaments, and borne on the ovary. The stigmas are generally 3, spreading, and about as long as the stamens. The ovary is 1-celled, immersed in the spadix, and consolidated with it. The seeds are small, light-brown, and attached to the parietal placentæ of the capsule. There is a pungent, disagreeable, somewhat aromatic odor, and a sharp, biting taste, imparted by all parts of the plant, when chewed, followed by a sense of astringency.

History and Description.—The Indians of Southern California, Mexico, and Arizona, according to Dr. Palmer (*Amer. Jour. Pharm.*, Dec., 1878), employ both the roots and leaves of this plant. Dr. William H. George, of California, first brought the drug to our notice, the root being the part employed. When dried, the roots are of a brown color, wrinkled, from ¼ inch to ½ inch in diameter, and seem to grow mostly horizontally near the surface of the ground. From 4 to 10 fleshy rootlets spring in a clump from one side of the root at the base of the leaves, and run downward. A strange peculiarity of the lot of roots examined by us, is, the presence of numerous grass stalks that pierce and grow through them, sometimes appearing several inches from the place of entrance. Internally, the root is pinkish; and, running lengthwise through it, about midway between the surface and the center, is a ring of course, fibrous, medullary matter. The upper portion of the root is not infrequently brown and half decayed.

Chemical Composition.—The active principles of this root are freely extracted by alcohol; they are, firstly, about 5 per cent of a volatile oil, which is heavier than water, is soluble in ether, alcohol, chloroform, and disulphide of carbon, and possesses the exact odor and taste of the plant. This oil turns blue when agitated with hydrochloric acid. Secondly, a vegetable tannate, which forms a black precipitate with ferrous sulphate. There is no alkaloid, or other body present, worthy of notice (*Amer. Jour. Pharm.*, Jan., 1880).

Action, Medical Uses, and Dosage.—This plant was introduced to the profession by Dr. W. H. George, of California. He states that the natives esteem it a panacea far excelling the Yerba santa, and successfully employ it in all *malarial fevers*, in *diarrhœa*, and in *dysentery* (*Eclectic Med. Jour.*, 1877, p. 238). In a letter to Prof. King, he observes that the natives frequently carry the root with them, chewing it and swallowing the juice, and consider it a certain remedy for *cough* and *pulmonary affections*. They likewise employ a strong infusion of it as an efficacious local application to *saddle and collar galls on horses*. Dr. George considers it a stimulant tonic, astringent, carminative, and anti-emetic. He has successfully employed it in *gonorrhœa* with profuse discharge, and thinks it equal to cubebs in this disease, and more pleasant to take. Prof. King has tried it in one case of *gonorrhœa*, and in several cases of *bronchial cough*, with favorable results. The dose of the fluid extract is from 10 to 60 minims, in syrup, repeated every 3 or 4 hours.

Related Species.—*Saururus cernuus*, Linné. *Nat. Ord.*, Saururaceæ. A common perennial known as *Lizard's tail*, found in swampy grounds in North America. Whitish flowers, borne upon a slender spike, recurved at the top; fruit fleshy and berry-like. The plant has a sub-acrid taste and a disagreeable, aromatic odor. Its constituents have not been determined. The decoction is freely used in *irritative disorders of the gastro-intestinal tract* and *urinary apparatus*, particularly *strangury*. As a poultice the root has been applied to painful *inflammatory swellings* and to various kinds of *abscess*.

ANETHI FRUCTUS.—DILL-FRUIT.

The *Anethum graveolens*, Linné. (*Peucedanum graveolens*, Hiern.)

Nat. Ord.—Umbelliferæ.

COMMON NAMES: *Dill seeds*, *Dill fruits*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, p. 132.

Botanical Source.—This plant is an annual, bearing large yellow flowers, disposed in flat umbels. It reaches a height of from 1 to 2 feet, and has delicately striated stems, bearing pinnate leaves composed of long, setaceous leaflets. The whole plant is glaucous. The root is long and fusiform.

History.—This plant is indigenous to Southern Russia and other Mediterranean regions; also to the Caucasian territories. It is cultivated in Europe, thriving as far north as the Scandinavian peninsula. It occurs in some sections as a common weed in cornfields. It is cultivated to a very limited extent in this country. It is scarcely used here as a medicine, but enjoys considerable reputation in England, where it holds a place in the *British Pharmacopœia*. It is said to have been known to Dioscorides, and is now regarded as the plant mentioned in the Scriptures (*Matt.*, ch. xxiii, v. 23).

Description.—ANETHI FRUCTUS. *Dill-fruit.* The seeds are oval or ovoid, seldom longer than $\frac{1}{5}$ inch, convex or flattish on one side, concave on the dorsum, which is striated or marked with piliform ridges 5 in number, the two outer ribs becoming blended with the thin, membranaceous margin surrounding the fruit. The 3 central or dorsal ridges are sharply keeled. Six vittæ (oil cells), are usually present, 4 between the ribs and 2 on the commissure. The mericarps separate when mature, are about $\frac{1}{10}$ inch in width, and of a brown color. The membranous marginal wings are of a yellowish color. The fruit has a strongly aromatic odor and taste. The fruit grown in India is smaller, not so broad, more prominently ribbed, more convex, and the margin less winged. Otherwise it resembles the above described European fruit.

Chemical Composition.—Dill-fruit yields a volatile oil to which its properties are probably due. This oil is obtained to the extent of 3 or 4 per cent, and was found by Gladstone to consist mainly of *anethene* ($C_{10}H_{16}$), a hydrocarbon having the odor of lemons, strongly dextrogyre, with boiling point at 172° C. (341.6° F.), and density of 0.846. Two other bodies have also been found (see *Oleum Anethi*).

Action, Medical Uses, and Dosage.—Carminative and stomachic, and used in the preparation of dill-water. The natives of India use the fruit largely in medicine and cookery. *Flatulent colic* and *singultus*, when due to disordered digestion, are relieved by the administration of dill-water or the oil of dill; the former in 1 or 2-drachm doses, the latter in from 2 to 5-drop doses on sugar. It possesses no advantages over the other aromatic seeds.

ANGUSTURA.—ANGUSTURA BARK.

The bark of *Galipea Cusparia*, St. Hiliare (*Galipea officinalis*, Hancock; *Cusparia febrifuga*, Humboldt; *Galipea febrifuga*, Baillon; *Bonplandii trifoliata*, Willdenow).

Nat. Ord.—Rutaceæ.

SYNONYM AND COMMON NAMES: *Cuspariæ cortex*, *Cusparia bark*, *Angostura bark*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 43.

Botanical Source.—This tree seldom exceeds 20 feet in height, with a stem whose diameter is from 2 to 6 inches, having irregular branches, and a smooth bark. The leaves are alternate, trifoliate, and petiolate; the leaflets oval, acute at the base, acuminate at the apex, smooth, glossy, bright-green, having a tobacco-like smell when fresh and bruised, from 6 to 10 inches long, 2 to 4 broad, some of them marked with small, whitish, round spots. The petiole is about the length of the leaflets, and slightly channeled. The flowers are white and beautiful, with a narcotic odor, and are borne in cylindrical, contracted, stalked panicles, longer than the leaves, the branches being about three-flowered. Calyx inferior, campanulate, five-toothed, hairy; corolla somewhat curved before expansion, nearly an inch long, downy on both sides; of the five petals, two larger than the others. Sterile stamens, five, subulate, tipped with a pellucid, watery gland; fertile stamens, two; style, erect; stigma, simple. The fruit or carpels are five, or fewer by abortion, becoming villous as they mature, two-seeded, with a strong, elastic, separable, two-valved endocarp (L.).

History.—There has been heretofore some uncertainty relative to the tree from which the official angustura bark is obtained, but the question has been definitely settled by Dr. Hancock, who has ascertained that it is chiefly the product of a tree to which he has given the above name. *Galipea officinalis*, now *Galipea Cusparia*, is official in the *British Pharmacopœia*. Under Hancock's name, it was formerly official in the *U. S. P.* It is found growing in great abundance in the missions of Carony, Tumeremo, etc., and other parts of Columbian Guiana.

Description.—The bark, as imported from the West Indian ports, is in flat pieces or incomplete quills, from 2 to 4 or even 8 inches long, 1 or 2 inches in breadth, and 1 or 2 lines in thickness. Its outer surface is dirty-grayish-yellow in color, often speckled in the smaller pieces with lighter gray spots and elevations; the inner surface is dull-brown; and the substance of the bark is yellowish-brown. It breaks easily, the transverse fracture being smooth and somewhat resinous in appearance; and presents white, shining striæ, produced by aggregations of crystalline, calcium oxalate; its powder has a grayish-yellow color, somewhat like that of rhubarb. When soaked in water, it is soon softened sufficiently to be easily divided by means of shears. It has a characteristic, unpleasant odor, and an intensely bitter, somewhat aromatic and acrid taste. Water, alcohol, or proof-spirits take up its virtues.

Chemical Composition.—Fischer found in it a volatile oil 0.3, peculiar bitter principle 3.7, bitter hard resin 1.7, balsamic soft resin 1.9, elastic resin 0.2, gum 5.7, lignin 89.1. By submitting the bark to distillation with water, a yellowish-white, odorous, acrid, volatile oil is obtained, which is not so heavy as water. The bark also contains nearly 1.5 per cent of a peculiar neutral, crystalline principle, named *cusparin* by Saladin, and termed the *peculiar bitter principle* by Fischer. Cusparin, or *angosturin* (Pereira), is obtained by submitting the alcoholic tincture of the bark (prepared without heat) to slow atmospheric evaporation; the crystals thus obtained are to be purified by repeated crystallization from alcohol and agitation with ether and hydrated oxide of lead. It forms tetrahedral crystals, is fusible at 44.4° C. (112° F.), and loses 23.09 per cent of its weight; cold water dissolves $\frac{1}{2}$ per cent and boiling water 1 per cent of it; it is freely soluble in alcohol, but not in ether or volatile oils; readily dissolves in the concentrated acids, and more sparingly in the alkalies, and its acid solution yields a whitish precipitate with the tincture of galls (Saladin, *Jour. de Chim. Med.*, IX, 388).

Cusparin, obtained in the cold, occurs in needle-like crystals. It is inflammable. The volatile oil, which has a boiling point at 266° C. (511° F.) is represented, according to Herzog, by the formula, $C_{13}H_{24}O$. Oberlin and Schlagdenhauffen, who examined the bark in 1878, found volatile oil, resin, fat, dissolved by alcohol; wax, fat, and stearic acid dissolved by benzin; moisture; and a bitter, yellow body, which yielded a crystalline alkaloid called by them *angusturine* ($C_{10}H_{40}NO_{14}$). It is fusible at 85° C. (185° F.), turns green when treated with sulphuric acid mixed with oxidizers—as nitric acid—but with pure sulphuric acid a red coloration ensues. In 1892 Beckurts and Nehring made a detailed investigation of the bark, isolating therefrom the following four alkaloids: *Cusparine* ($C_{20}H_{19}NO_3$) fusing point 98° C. (208.4° F.); readily soluble in alcohol and ether, its salts being difficultly soluble; *cusparidine* ($C_{19}H_{17}NO_3$) fusing point 78° C. (172.4° F.); *galipine* ($C_{20}H_{21}NO_3$) fusing point 115.5° C. (240° F.), and *galipidine* ($C_{19}H_{19}NO_3$) fusing point 111° C. (231.8° F.), the proper crystallizing solvent for the latter three alkaloids being light petroleum. The authors found, besides an *essential oil* extracted by means of ether. *angusturine*, a bitter principle insoluble in ether, having a fusing point of 58° C. (136.4° F.), and a glucoside not further examined. The bark was previously studied also by Koerner and Boehringer, in 1884, who found three alkaloids, one being identical in composition and fusing point with the *galipine* of Beckurts and Nehring.

Substituted Barks.—Some years since a poisonous bark was introduced as the true bark, and the administration of which was attended with fatal results. This spurious bark was at first supposed to be the product of the *Brucea ferruginea*, but is now recognized as the bark of *Strychnos Nux vomica*. It is known as the FALSE ANGUSTURA BARK, and may be detected by the following marks: The genuine bark has a strong and disagreeable odor; a bitter, durable, pungent taste; softens in water, and imbibes it quickly; is very light; tissue not compact; has a resinous, shining fracture, and when touched with nitric acid becomes colored a dull red; the false bark has no odor; an insupportably bitter, very durable taste; does not soften sensibly in water; is very heavy and compact; has a dull and blackish fracture, and nitric acid turns its fractured surface bright red and its rusty epidermis an intense green. The false bark is rarely met with in this country (Duncan). It contains *brucine*.

A bark known as *Brazilian angustura*, derived from *Esenbeckia febrifuga*, Martius, (*Evodia febrifuga*, St. Hilaire), and collected in Brazil, has been met with in substitution for angustura (Maisch, *Amer. Jour. Pharm.*, 1874, p. 414). It occurs in pieces a little curved, and having a thickness of about $\frac{1}{16}$ inch. It is very bitter, but not aromatic to the taste, nor does it swell when macerated in water. The inner layers are deep-brown, over which are blotches of a soft, corky layer of a brown-gray hue, having internally a faint, orange-rusty brown color. Its fracture is short and fibrous, and there is an absence of the white, shining striæ, due to the raphides of calcium oxalate found in the true bark. Oberlin and Schlagdenhauffen found in the Brazilian product an alkaloid turning yellow-green upon treatment with sulphuric acid. To this principle they gave the name *evodine* (*esenbeckine*), and the formula, $C_6H_{18}NO_6$.

Oberlin and Schlagdenhauffen record the following additional substitutions of angustura bark: Guaiacum bark, Copalchic bark, and the barks of *Cinchona bicolorata* and *Samadera Indica* (*Amer. Jour. Pharm.*, 1879, p. 83).

Action, Medical Uses, and Dosage.—In large doses, of from 20 to 60 grains, it is emetic and cathartic; in doses of from 5 to 15 grains, non-astringent tonic and febrifuge. Recommended in *bilious diarrhœas* and *dysenteries*, *intermittents*, *dropsies*, etc. It is seldom used, on account of its liability to adulteration with the poisonous bark of the *Strychnos Nux vomica*, known as the *False angustura bark*. Dose of the bark, 10 to 30 grains; of the infusion (℥ss in Oj), 1 to 2 fluid ounces.

ANILINUM.—ANILINE.

FORMULA: $C_6H_5.NH_2$. MOLECULAR WEIGHT: 92.83.

SYNONYMS: *Phenylamine, Amidobenzene, Anilina, Anilin, Phenamid.*

History and Source.—Aniline is named from the Portuguese *anil*, meaning indigo, from which aniline was first obtained. This name was given to it by Fritsche, in 1841, though it was first discovered by Unverdorben, in 1826, who obtained it by dry-distilling indigo, and named it *crystalline*. In 1834 Runge obtained from coal-tar three volatile bodies, among them one which, on account of the beautiful, dark, violet-blue color produced with chlorinated lime, he named *kyanol*. Zinin, in 1846, observed the formation of aniline from nitrobenzene by the agency of hydrogen gas, and called the substance *benzidam*. Erdmann and Hoffman then proved the identity of crystalline with kyanol, benzidam, and aniline. Coal-tar is a source of aniline, containing 0.3 to 0.5 per cent, but the principal source of aniline is nitrobenzene ($C_6H_5NO_2$), from which it is prepared in large quantities by the reducing action of nascent hydrogen, thus: $C_6H_5NO_2+H_6=C_6H_5NH_2+2H_2O$.

Preparation.—Aniline may be obtained on a small scale according to the process of Béchamp (*Amer. Jour. Pharm.*, 1862) as follows: Place 600 grains of iron filings and 500 grains of pure nitrobenzene into a quart tubulated retort, which must be adapted to a receiver, and the receiver connected by a bent tube with a deep, small-necked flask, into which it reaches nearly to the bottom. The neck of the retort, the receiver, and the flask must be kept well refrigerated, and the flask must be left loosely stopped with cotton. Now gradually pour 500 grains of concentrated acetic acid through the tubulure of the retort, which should be closed and tied, being careful that the temperature does not rise too high. Reaction soon commences without the application of heat, and becomes rapid, with quick rise of temperature and rapid ebullition, and a large portion of the products will be lost should the refrigeration be imperfect. The spontaneous distillate that comes over, consists of aniline, acetate of aniline, and a little unchanged nitrobenzene. When the retort has cooled, these are returned to it from the receiver, and a careful sand-bath heat applied until the residue in the retort is dry. Now mix the distillate with an excess of liquor potassæ, which causes the aniline to separate and rise to the surface, whence it is to be removed and dried; it is sufficiently pure for medicinal purposes, and its amount is equal to about three-fourths of the nitrobenzene employed. Hydrochloric acid is now generally employed in place of acetic acid, and milk of lime instead of liquor potassæ. Aniline may also be readily procured by distilling a mixture of concentrated liquor potassæ and finely powdered indigo; the mass swells up greatly, and water holding ammonia in solution passes over, accompanied by aniline in the form of a brownish oil, which, when redistilled, furnishes pure aniline amounting to nearly one-fifth of the weight of the indigo.

Description.—Pure aniline is a nearly colorless, limpid liquid, having an oily appearance, but when impure or partly oxidized, as often met with in commerce, it varies in color from a dark to a light red. It is of an agreeable, vinous odor, and an aromatic, burning taste, and remains fluid at —20° C. (—4° F.). Its specific gravity is 1.020 to 1.028, and its boiling point 182.2° C. (360° F.). It is heavier than water, in which it is slightly soluble to the extent of 3 per cent; is soluble in alcohol, ether, wood spirit, acetone, aldehyde, carbon disulphide, and fixed and essential oils, and has little or no action on test papers, though it changes dahlia-blue to green. It refracts light powerfully, is a non-conductor of electricity, rapidly absorbs oxygen, even under water, and becomes converted into a brown, resinous mass. Camphor, many resins, phosphorus, and sulphur (if heat be employed) are dissolved by it. Commercial aniline (pure) contains about 1 per cent, and other grades more, of *toluidine, i. e., ortho* and *para amido toluene* ($C_7H_7NH_2$). It is a powerful base, forming mostly colorless, soluble salts, with a strong tendency to crystallize, and become rose colored; and decomposes the salts of iron, zinc, aluminum, mercury, copper, etc. In contact with chlorinated lime, or other hypochlorites it forms at once a deep violet-blue. Another color test for aniline is as follows: To aniline add sulphuric acid and a few drops of potassium chromate; a red color is developed, changing to deep-blue if aniline is present. It is chiefly employed for the production of various magnificent colors used in dyeing, and which are made by different processes (see below).

Action, Medical Uses, and Dosage.—Aniline is poisonous, though Wöhler and Frerichs state that it is harmless to dogs. It has been observed that workmen employed in preparing aniline are liable to intense bronchitis, with violent, dry, spasmodic cough, coinciding with ulcerations of the scrotum and inferior extremities; the ulcers being round, with distinct borders, often callous, and covered with thick, blackish crusts, beneath which is a dirty-gray base, with a neighboring painful tumefaction, and which cease with the cessation of the cause. According to M. Bergeron, those who are exposed to its vapors present a chloroanemic appearance. In one case where a druggist was employed for two months in putting up packages of aniline, he was attacked with pulmonary catarrh, followed by prostration, tendency to syncope, occipital pains, dilatation of the pupils, and clonic convulsions of the extremities and muscles of the face; he was cured. According to Schuchardt and Demeyer, aniline belongs to the most violent poisons, and to that class which acts upon the nervous centers and the spinal marrow. The muscular contractions produced by it resembling electric shocks, the constant diminution of the sensibility, the paralytic state of the extremities, the acceleration of the respiration, and the activity of the heart, indicate this. It causes prickings of the parts with which it comes in contact, and its elimination seems to be by the respiratory organs, not by the urine. One grain of aniline coagulates 4 grains of albumen, demonstrating its toxic influence upon the animal tissues. The workmen in it present a cadaveric blue appearance, the gums discolored, the lips bluish-gray, a slight paroxysm of cold, headache, and vertigo, which are not permanent, however. Cases of poisoning are on record from wearing clothes which have been dyed with aniline colors. Six drachms of aniline oil, taken with suicidal intent, produced death in a woman in a few hours. After death, aniline was found in the urine, and the lungs, kidneys, and heart-muscle showed nodular hemorrhagic effusions. It is practically useless as a remedy. Dose: 1 to 5 grains (see *Aniline Sulphate* below).

Derivatives, Aniline Colors, and Inks.—ANILINE CAMPHORATE has been introduced by Tomaselli (*P. J. Tr.*, 1887) as a remedy for *convulsive disorders*. The daily dose administered being from 8 to 12 grains.

ANILINI SULPHAS, *Sulphate of aniline, Anilin sulphate.*—Formula: $(C_6H_5NH_2)_2.SO_4H_2$. Molecular Weight: 283.48. Dissolve 100 parts of aniline in 600 parts of alcohol (*U. S. P.*), to which add under constant stirring a freshly prepared mixture of 55 parts of pure, concentrated sulphuric acid, and 150 parts of alcohol. Allow the mixture to stand for a few hours in a dark place, then add under constant stirring about 400 parts of ether, transfer the magma of crystals on a funnel closed with a pellet of glass-wool, and displace the mother liquor by means of ether. Finally, dry the crystalline magma, without the aid of heat, by spreading it in thin layers on slabs of unglazed porcelain in a dark place. Avoid the use of filtering paper, and exclude bright daylight as much as possible (Hager). Sulphate of aniline forms small, crystalline, white plates or needles, without odor, if pure, but exposed to air and light acquires a reddish tint and an odor of aniline. It is soluble in water and diluted alcohol, much less soluble in strong alcohol, and insoluble in ether. Alkalies liberate from its aqueous solution an oily layer of its aniline, and the salt responds to the tests for sulphuric acid, as well as to all the tests for aniline. Sulphate of aniline has been used in *chorea* by Dr. Turnbull with success, and M. Filberti cured a case in four days, administering it in doses of 10 centigrammes twice a day, increasing it as much each day to prevent a relapse. He also cured a case of *epilepsy* by giving daily a solution of 5 centigrammes of aniline sulphate in 100 grammes of water, increasing the dose 5 centigrammes each day; in ten days the case was apparently cured. Others have also recommended it in these affections; while again it has been asserted that the sulphate of aniline has no influence upon the system. Its administration is apt to be followed by a blueness or yellowness of the skin, nails, and gums.

DIPHENYLAMINE.—Formula: $(C_6H_5)_2NH$. Molecular Weight: 168.65. This substance may be obtained by heating aniline hydrochloride with aniline to a temperature of 240° C. (464° F.) in closed vessels, the following reaction taking place:

$$C_6H_5NH_2.HCl + C_6H_5NH_2 = (C_6H_5)_2NH + NH_4Cl.$$

It is likewise formed when aniline is heated with phenol and zinc chloride ($ZnCl_2$) to a temperature of 260° C. (500° F.) (for description see No. 52 of *List of Reagents and Test Solutions*).

ANILINE COLORS.—Aniline as such ($C_6H_5NH_2$) enters into the composition of but few of what are usually called aniline dyes. Most frequently used are its homologues, the toluidines, ($C_6H_4CH_3NH_2$), its methyl derivatives, *e.g.*, mono- and di-methylaniline ($C_6H_5NHCH_3$) and ($C_6H_5N[CH_3]_2$), diphenylamine ($[C_6H_5]_2NH$,) and other amines. Many of the so-called aniline dyes as, *e.g.*, eosin, may not contain any aniline derivative at all, but have phenols as their principal constituent. Coal-tar dyes is a more comprehensive, and therefore more proper, name. The majority of these ever increasing dye-stuffs, may be classified broadly into two groups, according to whether they are derivatives of *triphenylmethane* ($CH:[C_6H_5]_3$), or of *azobenzene* ($C_6H_5{-}N{=}N{-}C_6H_5$). Oxy-triphenylmethane becomes a *chromogen* (a dye-forming principle), when the amido group (NH_2), or the phenol group (OH) replaces hydrogen in the benzene ring. In the first case the color is produced when combining with an acid, in the second, with an alkali. Fuchsin, for example, is the hydrochloride of the (colorless) basis *rosaniline*, which has the following formula: $C(OH):(C_6H_4NH_2)_2.C_6H_3(CH_3)NH_2$. Rosolic acid is similarly constituted, merely having OH in the place of NH_2, being an anhydride of the compound: $(HO)C:(C_6H_4OH)_2.(C_6H_3[CH_3]OH)$. Alkalies produce the colored salts in the latter case. If in the case of rosaniline the hydrogen of the NH_2 group is replaced by methyl, the resultant product acquires a violet color (methyl violet), or if substituted by the benzene radical the product has a blue color (aniline blue). The *azobenzene* type likewise becomes a prolific chromogen upon the entrance of the amido group (NH_2), or the phenol group (OH) in the benzene ring; in the first case we have basic dyes forming colored salts with acids; in the second, acid dyes, forming colored salts with alkalies. The simplest representative of this class of dyes, called *azo dyes*, is *aniline yellow*, the oxalate of (colorless) amido azobenzene ($C_6H_5{-}N{=}N{-}C_6H_4NH_2$). Another of the more simple azo dyes is *phenylene brown*, or *Vesurine*, the hydrochloride of the following compound: $NH_2{-}C_6H_4{-}N{=}N{-}C_6H_3[NH_2]_2$). These azo dyes are formed by the action of nitrous acid upon aniline or other aromatic primary amines (both H atoms in the NH_2 group being intact), whereby the extremely unstable (and explosive) *diazo compounds* are formed; these react easily with aromatic amines, or phenols, azo compounds being the result. In the case of aniline yellow for example, the following reactions are involved: $C_6H_6NH_2$ (*aniline*) $+ NO_2Na + 2HCl = C_6H_5{-}N{=}N{-}Cl$ (*diazo-benzene-chloride*) $+ 2H_2O + NaCl$. $C_6H_5N{=}NCl$ (*diazo-benzene-chloride*) $+ C_6H_5NH_2$ (*aniline*) $= C_6H_5N{=}N{-}C_6H_5NH_2$ (*amido azobenzene*, the basis of *aniline yellow*).

It is evident that when subjecting substituted amines to "diazotizing," and afterwards allowing a variety of amines or phenols to react with the diazo compound formed, and enlarging upon all possibilities, an endless variety of azo dyes must be the result. The following aniline or coal-tar dyes may find special mention here:

Aniline Red, *Magenta*, or *Fuchsine*, is a mixture of the hydrochlorides of rosaniline ($C_{20}H_{19}N_3$) and para-rosaniline ($C_{19}H_{17}N_3$) and is produced on a large scale by the oxidation of aniline (containing toluidine) with arsenic acid (Medlock and Girard), or with nitrobenzene (Coupier). It is stated that fuchsine obtained by the arsenic acid process, is liable to contain arsenic; this dangerous impurity is said to be removable by recrystallization. The acetate of rosaniline is usually called Rosein; the nitrate is called Azaleine. The latter was formerly prepared by oxidizing aniline oil with mercuric nitrate.

Fuchsine, the hydrochloride, forms crystals of a green, metallic lustre, in reflected light. It is soluble in 10 parts of alcohol, and 300 parts of water. On account of its insolubility in pure volatile oils, it is employed to detect the presence of alcohol in them. It is also employed as a valuable staining material in bacteriology, and in botany for staining lignified cell-walls (Bastin). Fuchsine is sometimes used to color wines, and though apparently of use in *tubular nephritis* and *scarlatinal dropsy*, its position as a remedy is as yet by no means well established. The dose is from ½ to 4 grains 3 or 4 times a day.

Hofmann's Violet, Methyl Violet.—*Hofman's violet* is obtained by the action of methyl or ethyl chloride, or iodide, upon rosaniline salts, whereby three H atoms of the NH_2 groups are substituted by the methyl or ethyl group. The violet tint becomes more bluish the more hydrogen atoms are substituted.

Methyl Violet, in its purest form, is a salt of penta-methyl rosaniline, the commercial grade also containing hexa-methyl rosaniline. It is prepared by oxidizing dimethyl-aniline with copper chloride. When acted upon by methyl chloride or methyl iodide, it forms addition products, the zinc double chlorides of which are called Methyl Green, or Iodine Green, respectively.

Pyoktanin, related to methyl violet, was introduced in 1890, into medical practice, for general surgical purposes; it was claimed that it retarded the growth of bacteria and bacilli in a solution of 1 to 30000, and prevented putrefaction in a solution of 1 to 1000 (*Amer. Jour. Pharm.*, 1890). There are two pyoktanins in the market, a *blue pyoktanin* (*pyoktanin cæruleum*), probably tetra-penta- and hexa-methyl violet, and a *yellow pyoktanin* (*pyoktanin aureum*), intended for ophthalmic practice, probably belonging to the auramines (diphenyl-amine derivatives).

Pyoktanin was introduced into medicine by Prof. J. Stilling, of Strasburg. Hypodermatically, it is said to relieve *rheumatic* and *neuralgic pains*. To the conjunctiva it is a mild topical anæsthetic. It is employed in powder (with talc), and in pencils. *Wounds, ulcers, carbuncles, buboes, boils*, etc., as well as *gonorrhœa* and *chronic cystitis* have been successfully treated with it. In various *eye and ear troubles* it has also been used by some with apparently good results, while others condemn it severely, attributing much harm to its use, as well as claiming injury from its staining properties. The stains of pyoktanin may be removed by alcohol or diluted nitric or hydrochloric acids. Very likely some of its deleterious effects may be attributed to impurities.

Aniline Blue is the salt of triphenyl para-rosaniline $HOC{:}(C_6H_4NH[C_6H_5])_3$, and is obtained by boiling together a rosaniline salt with an excess of aniline.

Malachite Green is the oxalate or zinc double chloride of tetra-methyl-diamido-triphenylcarbinol, ($C_6H_5.C[OH]{:}C_6H_4N[CH_3]_2$), and is obtained by heating benzaldehyde with dimethyl aniline and zinc chloride or oxalic acid, and acting upon the product with oxidizers.

Aurin, Pararosolic Acid. Corallin Yellow ($C_{19}H_{14}O_3$), is the lower homologue of rosolic acid, and is prepared by heating phenol with oxalic and sulphuric acids. It forms red needles or prisms of metallic luster, is soluble in hydrochloric and acetic acids and alcohol, and dissolves in alkalies with a deep-red color, forming salts therewith. (See *Corallin Test Solution*).

Corallin Red (*Pæonin*), is an intermediary product between para-rosaniline, and aurin, containing one or two amido groups besides the remaining phenol groups.

Rosolic Acid ($C_{20}H_{16}O_3$), one of the indicators directed by the *U. S. P.* (see *Rosolic Acid Test Solution*), may be obtained from rosaniline by "diazotizing" and boiling with water, which has the effect of replacing the NH_2 group by the OH group It may also be prepared in a way analogous to that in which rosaniline is made, viz., by oxidizing a mixture of phenol and cresol ($C_6H_4[CH_3]OH$) with arsenic and sulphuric acids.

Phtaleines. These are also phenol derivatives of triphenyl-methane. and are obtained by heating phthalic anhydride (1 Mol.) with phenols (2 Mols.), in the presence of sulphuric acid, oxalic acid, or stannic chloride.

Phenolphtalein is formed by treating phthalic anhydride with phenol and stannic chloride. Its formula is: $C_{20}H_{14}O_4=C_6H_4.(CO.O).C{:}(C_6H_4OH)_2$. It is a yellow powder, soluble in alcohol, the solution forming an intense red with alkalies. It is directed by the *U. S. P.* as an important indicator in alkalimetry (see *Phenolphtalein Test Solution*).

Fluorescein. This substance is prepared by heating phthalic anhydride (5 parts), with resorcin (7 parts), to 200° C. (392° F.); for reasons of analogy it may therefore be called resorcin-phthalein. Its composition is: $C_{20}H_{12}O_5+H_5O=C_6H_4.(CO.O)C{:}(C_6H_3[OH]_2)_2$.

Eosins are the alkali salts of halogen substitution products of fluorescein; *eosin yellow*, for example, is the salt of tetra-brom fluorescein, and *eosin blue* is that of tetra iodo-fluorescein. Fluorescein and eosin are among the indicators directed by the *U. S. P.* (see *Indicators*).

Methyl Orange is an azo dye, which occurs under the names of *Helianthin*, *Orange III*, *Poirrier's Orange* 3P, and *Tropæolin D*. Its formula is $SO_3H.C_6H_4—N=N—C_6H_4N(CH_3)_2$, from which it is evident (see introductory remarks) that it is prepared from sulphanilic acid and dimethyl aniline. In water and alkalies it dissolves with a light-yellow color, which turns red with acids. For its use as an indicator see *Methyl-orange Test Solution*.

Methylene Blue, *Tetramethyl thionin chloride* ($C_{16}H_{18}N_3SCl$). This must not be confused with aniline blue, a trisulphonate of which is called *methyl blue*, which belongs to the triphenyl-methane group, while methylene blue belongs to an entirely different group. It is produced by treating an acid solution of dimethyl para-phenylene diamine ($NH_2.C_6H_4.N[CH_3]_2$), with hydrogen sulphide and ferric chloride. The blue solution is then precipitated with NaCl and $ZnCl_2$. Methylene blue occurs in scale-like blue crystals having a bronze tint, and being easily soluble in water. The formation of this substance is utilized as a delicate test for hydrogen sulphide (E. Fischer and Bernthsen).

Methylene blue is used in the arts as a dye-stuff. Medicinally, it has been employed as an antipyretic, anodyne, and antiperiodic. *Rheumatism, gonorrhœa, cystitis, pyelitis,* and *malaria*, have been treated with it. It has also been employed in the treatment of *cancer*. The internal dose is 2 to 4 grains in capsules; as an injection, 1 grain in solution.

Prof. F. J. Locke reports success with this agent in *old tibial ulcers*. His method is to dissolve 20 grains of methylene blue in 1 fluid ounce of water, and with this solution paint the ulcers night and morning, keeping the parts covered with a cloth wetted with a 1 to 1000 corrosive sublimate solution. After each treatment the limb should be covered with an elastic bandage.

Aniline Black, *Jetoline*. Its formula is a multiple of C_6H_5N, perhaps $C_{18}H_{15}N_3.HCl$ (Liechti). It is produced on the fiber direct by slow oxidation of aniline by means of potassium chlorate and copper chloride, or hydrochloric acid and potassium bichromate (*Amer. Jour. Pharm.*, 1880), or more recently with ammonium vanadate. The resulting dark-green color appears black.

Aniline Inks. *Aniline inks* are prepared by dissolving 15 parts of dry aniline dyes (either red, blue, green, or yellow), in 150 parts of strong alcohol and 1000 parts of distilled water, in a porcelain-lined vessel by the aid of a gentle heat, until the odor of alcohol is dissipated, and adding a solution of 60 parts of gum arabic in 250 parts of water (*Amer. Jour. Pharm.*, 1868, p. 332). An *indelible ink* may be made with aniline black as follows: 1, dissolve crystallized chloride of copper $17\frac{3}{4}$ parts, chlorate of sodium $22\frac{5}{8}$ parts, and chloride of ammonium $11\frac{7}{48}$ parts, in distilled water 125 parts; 2, dissolve chlorohydrate of aniline 2 parts, in distilled water 3 parts, and add to it of a solution of 1 part gum arabic to 2 parts of water, 2 parts, and glycerin 1 part. Mix 4 parts of No. 2 with 1 part of No. 1, as wanted. It forms a greenish liquid, which may be applied with pen, pencil, or brush. As it changes in a few days, it should be mixed only as wanted (*Ibid*, p. 335).

Stamping Ink. Dissolve any aniline dye 5 parts, in hot water 75 parts; add syrup 1 part, and glycerin 2 parts.

ANISUM (U. S. P.)—ANISE.

"The fruit of *Pimpinella Anisum*, Linné"—(*U. S. P.*). (*Anisum vulgare*, Moench).

Nat. Ord.—Umbelliferæ.

Common Names: *Aniseed, Anise.*

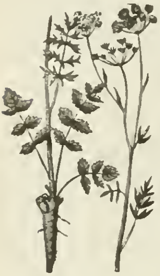
Illustration: Bentley and Trimen, *Med. Plants*, 122.

Botanical Source.—Anise has a perennial, spindle-shaped, ligneous root, and smooth, erect, branched stem, 10 or 12 inches in height. The leaves are petioled; the radical ones roundish, heart-shaped, lobed, and cut serrated; the cauline ones biternate, with linear-lanceolate, rather cuneate-acuminate segments. The flowers are small and white, and borne in umbels on long stalks, and are 9 or 10-rayed, and naked; the partial ones have a few subulate, reflexed bracts. Calyx wanting or minute; corolla of 5 obovate, emarginate petals, with an inflexed lobe. Stamens 5, longer than the petals. The anthers are roundish, the styles subulate, spreading, long, and capitate. The fruit is ovate, $1\frac{1}{2}$ lines long, dull-brown, slightly downy, not at all shining; half-fruits or mericarps with 5 filiform, equidistant, elevated ridges, sometimes rather wavy, and paler than the channels. The commissure is broad and flat (L.).

History.—Anise originally came from Egypt, and is at present cultivated in many of the warm countries of Europe; the fruit of the Spanish plant is that which is more generally selected for medical purposes. The fruit, popularly called *aniseed*, is the official portion. Care must be taken not to confound any of the seed of the poisonous umbelliferous plants, as of the *Conium maculatum*, with those of the anise; a little attention will detect any accidental admixture of this kind, as the differences in the seed are well marked. The odor of anise is penetrating, and fragrant, and the taste aromatic and sweetish (P.). Water partially takes up its properties, alcohol wholly so; these are due to a volatile oil which may be procured by distillation of the fruit with water.

Description.—"About 4 or 5 Mm. (⅙ to ⅕ inch) long, ovate, compressed at the sides, grayish, finely hairy, and consisting of 2 mericarps, each with a flat face, and 5 light-brownish, filiform ridges, and about 15 thin oil-tubes, which can be seen in a transverse section by the microscope. It has an agreeable, aromatic odor, and a sweet, spicy taste. It may be distinguished from conium fruit (which it somewhat resembles, and which has been mistaken for it), by the odor and taste, and by the conium fruit consisting usually of single mericarps, which are smooth, grooved upon the face, and have crenate ridges with wrinkles between them, and no oil-tubes"—(*U.S.P.*).

Fig. 25.



Pimpinella Anisum.

Chemical Composition.—A volatile oil is contained in the external coat of the seeds, while a green-colored, fat oil of a butyraceous consistency, is obtained by expression of their inclosed substance. Brandes obtained from the fruit of anise, concrete fixed oil, green fat oil, resin, nitrogenous matter, sugar, gum, bimalate and binacetate of calcium. bimalate of potassium, volatile oil, lignin, silicate of iron, water, gum-resin, phosphate of calcium, extractive with various salts, etc.

The star-anise of cordial manufacturers possesses a taste and odor similar to the anise, but is procured from the *Illicium Anisatum*, Loureiro, a plant growing in Eastern Asia. A volatile oil is obtained by distillation from its fruit, which is often fraudulently substituted for the oil of anise; it is called *oleum badiani* or *oil of star anise.* Oil of common anise is sometimes adulterated with spermaceti or camphor, to promote its solidification; the former may be known by its insolubility in cold alcohol, the latter by its odor.

Oil of anise yields, upon oxidation, *anisic acid* ($C_8H_8O_3{=}C_6H_4[OCH_3]COOH$). This acid occurs in the form of colorless crystals, insoluble in water, but freely soluble in alcohol. It is an oxidation product of *anethol* ($C_{10}H_{12}O$) (the chief principle of the oils of anise [94 per cent, Flückiger], star anise and fennel), obtained by fractional distillation of the oil of anise, reserving and purifying that fraction distilling from 230° to 234° C. (446° to 453.2° F.).

Action, Medical Uses, and Dosage.—A stimulant and carminative; used in cases of *flatulency*, *flatulent colic of infants*, and to remove *nausea*. Sometimes added to other medicines to improve their flavor, correct griping and other disagreeable effects. The dose of aniseed, crushed or powdered, is from 20 to 40 grains. Infusion (ʒij or ʒiij to aqua Oss.), for infants, in doses of a teaspoonful.

Derivatives.—Anisic acid is claimed to be antipyretic and antiseptic, acting very much like salicylic acid, and has been employed with reputed success in *articular rheumatism*, and as a topical application to *wounds*. For internal use *sodium anisate* is preferred, the acid being but little used. Dose of the salt, 15 grains.

ANTENNARIA.—PEARLY EVERLASTING.

The leaves of the *Antennaria margaritacea*, Robert Brown; (*Gnaphalium margaritaceum*, Linné.

Nat. Ord.—Compositæ.

Common Names: *Pearly everlasting, Pearl-flowered life everlasting.*

Botanical Source.—Antennaria margaritacea is a perennial plant, with a simple, erect stem, corymbosely branched above. The leaves are linear-lanceolate, acute, 3-veined, sessile, and beneath the stem woolly; the corymbs are many-flowered and fastigiate; the scales of the hemispheric involucre are elliptic, obtuse, opaque, pearl-white, the outer ones only tomentose at the base; heads diœcious; the pistillate flowers are very slender; pappus simple, bristly, capillary in the fertile flowers, and in the sterile club-shaped, or barbellate at the summit. The corolla is yellowish (W. G.).

History and Chemical Composition.—The name *Antennaria* is from the resemblance of the sterile pappus to the *antennæ* of many insects (W.). The plant is slightly fragrant, and grows in dry hills and woods of various parts of the United States; it is from 1 to 2 feet in height, and bears yellow and white flowers in July. The leaves are the parts used. They contain a bitter principle and an essential oil.

Action, Medical Uses, and Dosage.—Anodyne, astringent, and pectoral. A decoction has proved beneficial in *diarrhœa* and *dysentery*, and in *pulmonary affections*. Externally, it forms an excellent poultice in *sprains*, *bruises*, *boils*, *painful swellings*, etc., and is said to produce sleep when applied externally to the head, even in cases where a poultice of hops has failed. Rafinesque is authority for the statement that the Indians, for a trifle, would allow rattlesnakes to bite them, to show that they could cure the bite at once with this plant. Decoction (℥j to aqua Oj) freely.

Related Species.—*Antennaria plantaginifolia*, Robert Brown. (*Gnaphalium plantaginifolium*, Linné; *G. plantagineum*, Pursh; *G. dioicum*, var. *plantaginifolium*, Michaux). *Plantain life everlasting. Cudweed. Mouse-ear everlasting.* Canada and the United States, in open woods and barren hills. Domestic remedy, when boiled in milk, for *diarrhœa* and *dysentery*. Reputed efficacious in *bites of poisonous reptiles*.

Antennaria dioica, Gærtner (*Gnaphalium dioioum*, Linné). Europe. Used the same as preceding species.

Antennaria arenarium, Linné. Europe and Asia. Uses same as preceding species.

Gnaphalium polycephalum, Linné. (See *Gnaphalium*).

ANTHEMIS (U. S. P.)—ANTHEMIS.

"The flower-heads of *Anthemis nobilis*, Linné, collected from cultivated plants"—(*U. S. P.*).

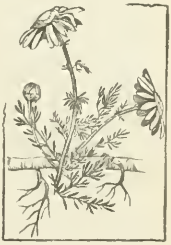
Nat. Ord.—Compositæ.

COMMON NAMES AND SYNONYMS: *Chamomile*, *Roman chamomile*, *Anthemidis flores*, *English chamomile*, *Flores chamomillæ Romanæ*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 154.

Botanical Source.—This is a perennial herb, with a strong root, having long fibers. The stems, in a wild state, are prostrate, but more upright when cultivated in gardens. They are about a span long, round, hollow, furrowed, downy, leafy, and branched. The leaves are doubly pinnate, sessile, and pale-green in color, having small, thread-shaped leaflets, which are rather flat or channeled above, convex beneath, somewhat downy, acute, and commonly trilobed. The flower-heads are terminal and solitary, with ligulate, white, ray-florets, and a yellow center of tubular florets.

Fig. 26.



Anthemis nobilis.

History and Chemical Composition.—Chamomile is indigenous to Southern Europe, where it is cultivated for the purposes of medicine, and gathered and quickly dried by artificial heat. There are two varieties, the single and the double, of which the former is the best, the latter being commonly the result of cultivation. The white flowers are the best; they have an aromatic, agreeably bitter taste, a strong and peculiar odor, and yield by distillation 0.45 per cent of a volatile oil of a pale-blue color at first, but gradually becoming brownish or yellowish (*Oleum Anthemidis*). Their aromatic and stimulant properties are due to this oil and a resin; their tonic to bitter extractive and tannic acid. They also contain chlorophyll, albumen, extractive, gum, salts, fat, and glucose. Camboulises (1871) obtained *quercitrin*, a yellow, coloring matter, when boiling the ether extract of the drug with water, and allowing it to cool. The filtrate yielded to ether a crystallizable, bitter principle, which Camboulises thought identical with anthemic acid, supposed to have been obtained by Pattone in 1859 from Anthemis arvensis. No alkaloid was found in the drug. A fixed oil may be obtained from the seeds by expression. The flowers yield their properties to water or alcohol. The wild flowers are seldom met with in commerce, and the darker grades of flowers, probably gathered in bad weather, bring a lower price.

Description.—The flower-heads are rather larger than a daisy, with a convex, yellow disk and numerous white, spreading, or reflexed rays. The involucre has small, shining, membranous-bordered scales, rather downy. The receptacle is obtusely conical, with minute, chaffy scales, which do not appear until the disk-florets are turned to one side; the innermost are gradually narrowest. The ray-florets are white, strap-shaped, and tridentate; about eighteen in number when wild (usually in a single row), but when cultivated may be more numerous, the disk-florets often taking on a ligulate form and becoming white. The disk-florets are yellow, many, tubular, and consist of five segments. The stamens are five in number, the ovary obovate, the style slender, and the stigma two-cleft and reflexed. The ovate seeds are flat.

The flowers directed by the Pharmacopœia are those of the cultivated plant, and are thus described in that work: "Heads subglobular, about 2 centimeters (¾ inch) broad, consisting of an imbricated involucre, and numerous white, strap-shaped, three-toothed florets, and few or no yellow, tubular disk-florets, inserted upon a chaffy, conical, solid receptacle. It has a strong, agreeable odor, and an aromatic, bitter taste"—(*U. S. P.*).

Admixtures.—The flower-heads of *Matricaria Chamomilla*, Linné (*German chamomile*); *Maruta Cotula*, DeCandolle (*Mayweed*); *Achillea Ptarmica*, Linné (*Sneezewort*); *Pyrethrum Parthenium*, Linné (*Feverfew*); *Anthemis arvensis*, Linné (*Corn chamomile*), and of other species of compositæ are sometimes admixed with chamomile flowers as adulterants. The double flowers of Roman chamomile (*Anthemis nobilis*) may be determined from the double flowers of Feverfew (*Pyrethrum Parthenium*) by the following characters: *A. nobilis* flowers have a peculiar and pleasantly aromatic odor; the involucre is nearly flat, and composed of a number of spreading, nearly equal, overlapping bracts, with broadly and evidently membranous margins; when the florets are removed, the receptacle is observed to be a solid, conical body, more or less pointed at the apex, and the scales on it are thin, concave, blunt-pointed, or obtuse, more numerous, more closely compacted, and more membranous than those of *P. Parthenium*. The flowers of *P. Parthenium* are less double than those of *A. nobilis*, have a strong, peculiar, and more or less unpleasant odor; the involucre is convex, and composed of a number of nearly equal, imbricated, concave bracts, which are bent inward above, and each having a prominent ridge on its dorsal surface; when the florets are removed the receptacle is observed to be slightly convex or nearly flat, and rounded above, and the scales on it are lanceolate, acute-pointed, less in number than those of *A. nobilis*, and less membranous.

The Common, or Wild chamomile, German chamomile (*Matricaria Chamomilla,*) is usually with single flowers, which have a strong, peculiar, unpleasant odor, a convex involucre, composed of nearly equal, obtuse-pointed bracts, not distinctly membranous at their margins, and the receptacle is hollow, broadly conical, or nearly cylindrical in shape, naked, or without any scales.

The flowers of the *Achillea Ptarmica* have rounder rays, much shorter than those of *A. nobilis*, and are odorless, but have a harsh, acrid taste.

Maruta Cotula may be known by its disagreeable odor, which differs from that of chamomile, while the *Anthemis arvensis* is without odor. The former has an almost cylindrical receptacle, studded with slender, permanent scales.

Action, Medical Uses, and Dosage.—In doses of from ½ drachm to 2 drachms of the flowers, or from 1 to 3 fluid ounces of their infusion (℥ss to aqua Oj), chamomile is a tonic; from 5 to 12 fluid ounces of a warm, strong infusion usually vomits. The cold infusion has proved useful in *dyspepsia*, *weak digestion*, and in all cases of *weak* or *irritable stomach*, as well as in obstinate *gastro-intestinal irritation;* also in *intermittent* and *typhus*. The oil is carminative and antispasmodic. Used in *flatulency*, *colic*, *cramp in the stomach*, *hysteria*, *nervous diseases*, and *painful dysmenorrhœa*. *Colds*, when due to sudden checking of the cutaneous secretions, are quickly relieved by anthemis, as are also recent cases of *rheumatism* and *neuralgia*, brought on in the same manner. In *amenorrhœa* from cold immerse the feet in mustard water, and after putting the woman to bed, give freely of the warm infusion. Dose of the oil, 5 to 15 drops on sugar; specific anthemis, 1 to 5 drops. The flowers of the *Matricaria Chamomilla* (see *Matricaria*) possess similar properties to the anthemis. A poultice of chamomile flowers is said to prevent *gangrene* and to remove it when present.

Specific Indications and Uses.—Gastro-intestinal debility; flatus; dysmenorrhœa from cold; malarial affections. A tonic and antispasmodic.

ANTIMONII ET POTASSII TARTRAS (U. S. P.)—
ANTIMONY AND POTASSIUM TARTRATE.

FORMULA: $2K(SbO)C_4H_4O_6+H_2O$. MOLECULAR WEIGHT: 662.42.

SYNONYMS: *Tartar emetic, Tartarated antimony, Antimonium tartaratum, Antimonium tartarisatum (Tartarizatum), Antimonii potassio-tartras, Tartarized antimony, Tartarus emeticus.*

"Antimony and potassium tartrate should be kept in well-stoppered bottles"—(*U. S. P.*).

History and Preparation.—Mynsicht, in 1631, prepared this salt from crocus of antimony (saffron of antimony) and cream of tartar (potassium bitartrate); Glauber, in 1648, employed cream of tartar and flowers of antimony. This preparation is made in various ways, the readiest of which is to boil together 4 parts of oxide of antimony and 5 parts of bitartrate of potassium, both in fine powders, previously mixed, in 36 parts of distilled water; filter the liquid, concentrate, and crystallize by slow cooling. These proportions are the same as directed in the *U. S. P.* (1870), but boiling water was directed, into which the mixed powders were to be introduced and boiled for 1 hour.

The *British Pharmacopœia* directs: "Take of oxide of antimony, 5 ounces (av.); acid tartrate of potassium, in fine powder, 6 ounces (av.); distilled water, 2 pints (*Imp.*). Mix the oxide of antimony and acid tartrate of potassium with sufficient distilled water to form a paste, and set aside for 24 hours. Then add the remainder of the water, and boil for a quarter of an hour, stirring frequently. Filter and set aside the clear filtrate to crystallize. Pour off the mother liquor, evaporate to one-third, and set aside that more crystals may form. Dry the crystals on filtering paper at the temperature of the air"—(*Brit. Phar.*).

Whatever process is pursued, it is essential that the antimony oxide be slightly in excess that crystals of free cream of tartar be not deposited with the tartar emetic. The British process obviates long boiling, which tends to prevent the formation of an uncrystallizable portion, and the coloring of the crystals necessitating recrystallization. The antimonous oxide should be wholly free from oxychloride, and the cream of tartar free from calcium tartrate, the latter necessitating recrystallization and the former partially preventing crystallization, on account of rendering the solutions acid. Some manufacturers use an impure antimonous oxide, having methods by which they can purify the product to advantage, but the producer on a small scale should rely upon pure materials. The oxychloride was used instead of the oxide by Berzelius and Henry. In London, antimony ash is largely employed in manufactories for the preparation of this salt.

The reaction in preparing this salt is as follows: $Sb_2O_3+2KHC_4H_4O_6=2(K[SbO]C_4H_4O_6)+H_2O$, the hydrogen being displaced by the radical *antimonyl* (SbO), which is univalent.

Description.—"Colorless, transparent crystals of the rhombic system, becoming opaque and white on exposure to air; or a white, granular powder, without odor, and having a sweet, afterwards disagreeable, metallic taste. Soluble in 17 parts of water at 15° C. (59° F.), and in 3 parts of boiling water, but insoluble in alcohol, which precipitates it from its aqueous solution in the form of a crystalline powder. When heated to 110° C. (230° F.), the salt loses its water of crystallization (2.71 per cent). When heated to redness, it chars, emits an odor resembling that of burning sugar, and leaves a blackened residue having an alkaline reaction. The aqueous solution of the salt possesses a slightly acid reaction, and yields, with hydrochloric acid, a white precipitate soluble in an excess of the acid; but no precipitate occurs if tartaric acid had previously been added"—(*U. S. P.*).

If tartar emetic be prepared from the oxychloride, tetrahedral crystals form. Wine and proof-spirit dissolve the salt, which, as met with in commerce, is usually powdered. Its solution in water is unstable, but decomposition may be prevented by adding one-fifth part of alcohol. Tartar emetic is incompatible with the concentrated and diluted acids, alkalies, most metals and their carbonates, hydrosulphides, soaps, gallic and tannic acids, and most astringent, bitter bodies, as Peruvian bark, rhubarb, etc. These latter render it weaker in quality, while galls render it quite inert.

Tests.—"In a solution of the salt, acidulated with hydrochloric acid, hydrogen sulphide T.S. produces an orange-red precipitate. The aqueous solution, even when largely diluted, at once becomes permanently turbid on the addition of a small quantity of potassium carbonate or calcium hydrate T.S. A 1 per cent aqueous solution of the salt, acidulated with acetic acid, should not be affected by the addition of a few drops of barium chloride T.S. (absence of sulphate), silver nitrate T.S. (chloride), ammonium oxalate T.S. (calcium), or potassium ferrocyanide T.S. (iron and other metals). On adding sodium carbonate T.S. to crushed crystals of the salt, effervescence should not ensue (absence of potassium bitartrate). If 1 Gm. of the salt be dissolved, with the aid of heat, in hydrochloric acid, and to this solution 1 Cc. of stannous chloride T.S. be added (see *List of Reagents*, Bettendorff's Test for Arsenic), together with a small piece of pure tinfoil, no turbidity or coloration should ensue within 1 hour (limit of arsenic). If 0.331 Gm. of the crystallized salt, or 0.322 Gm. of the salt dried at 110° C. (230° F.), be dissolved in 10 Cc. of water and about 20 Cc. of a cold, saturated solution of sodium bicarbonate and a little starch T.S. added, it should require not less than 20 Cc. of decinormal iodine V.S. to produce a permanent blue color (corresponding to 100 per cent of the pure salt"—(*U. S. P.*).

Potassium sulphate, to the extent of from 40 to 70 per cent, was found in commercial tartar emetic by A. H. Jackson—(*Year Book of Pharm.*, 1885).

Action and Toxicology.—Applied to the skin, a strong solution or ointment of tartar emetic produces a pustulous eruption of a peculiar character, accompanied with a more or less intense inflammation. The pustules resemble those of variola, and when the scab drops an indelible cicatrix remains. Internally, oft-repeated, small amounts ($\frac{1}{50}$ to $\frac{1}{100}$ grain) produce an uncomfortable feeling, with nausea, colic, diarrhœa, anorexia, debility, pasty tongue, and possibly an eruption of pustules. Emetic doses occasion nausea, a sensation of sinking, free ptyalism, violent and protracted retching and vomiting, with cold extremities, and a cool, perspiring skin. If given with plenty of fluid, purgation, may result instead of emesis. Taken internally, in large quantities, tartar emetic acts as a violent poison, and may produce a very lively inflammation of the intestinal canal, as manifested by excessive vomiting, hypercatharsis, tenesmus, great heat and pain in the gastric region, colicky symptoms, oppressed breathing, cold surface, and gradual loss of the senses and vital powers. The antidotes are infusions of Geranium maculatum, table tea, solution of tannic acid, or other vegetable astringent and mucilaginous infusions, aided by preparations of opium to check the excessive evacuations; together with the usual means for combating inflammatory symptoms. Alcohol and digitalis may be required to support the heart. The quantity sufficient to kill is small. A child was killed by $\frac{3}{4}$ of a grain; an adult by 2 grains, but circumstances favored the accident; 15 grains killed a young man in 6 hours. On the other hand, recovery has taken place after a teaspoonful had been taken. Enteritis and loss of hair were the secondary results (see Taylor, *Med. Juris.*).

Medical Uses and Dosage.—Tartar emetic was formerly much used as an emetic in doses of from 1 to 4 grains, dissolved in a tumblerful of warm water, of which 1 or 2 tablespoonfuls were to be given every 5 or 10 minutes, until vomiting was produced, aiding its operation by frequent draughts of warm water. It has likewise been employed as a nauseant and diaphoretic in *febrile* and *inflammatory diseases*, especially of the thoracic organs; the dose varying from $\frac{1}{4}$ of a grain to 1 grain, every 1, 2, or 4 hours. One or 2 grains in a pint or two of water will generally act as a purgative. In doses of 4 grains, gradually increased to 20 or even 40 grains during the 24 hours, Rasori, Laennec, Balfour, and others have considered it very useful in acute inflammations, as *pneumonia*, *hepatitis*, *jaundice*, etc. It was thus said to exert a sedative or contra-stimulant effect, and could only be advantageously administered in this way, provided the first doses did not produce vomiting nor superpurgation, and the stomach become in that state termed *tolerance*. A prominent old-school writer, the therapeutic editor of the *National Dispensatory*, has justly characterized the mischief done by tartar emetic, used as an emeto-cathartic, as "one of the medical scandals of the sixteenth century," and hoped that the tendency toward its revival, as was manifested a few years since (1882–7–8), would be checked by those who were acquainted with "its martyrology." It will be remembered that the abuse (not the use) of this agent was one of the potent factors in bringing into existence the Eclectic School of Medicine. The use of tartar emetic in the Eclectic School has been very limited. It never has been employed in the same manner as by the old school, and never as an emetic. The only field of action thus far determined for it has been in *broncho-pulmonary disorders* of a sub-acute character, particularly in *sub-acute inflammation of the bronchioles.* "The simplest indication," says Prof. Scudder (*Spec. Med.*), "for the *minute* dose of this remedy is increased secretion of the respiratory mucous membrane. To this may be added a feeble pulse, pallid skin, cool extremities, cold sweats, uneasiness in the lower abdomen, and frequent desire to go to stool and urinate. If we were giving it in the old-fashioned dose, the indications would be the reverse of this." Its usefulness in *capillary bronchitis* is marked. The increased secretion, with lack of power to expectorate, the rattling cough, persisting until the sputa is finally dislodged, and attended with a sense of faintness, difficult, suffocative breathing, wheezing, and loudly subcrepitant, bronchial *rales* are the guides to its use. Add to these a pallid surface, bathed in a cold, clammy sweat, a cyanotic countenance, with frequent urgings to empty the bowels and bladder, and hypogastric uneasiness, and it is the remedy for this unpleasantness, and when indicated by the whole or a portion of these symptoms, and particularly by the free secretion, with lack of power to dislodge the sputa, the act being feeble and attended with faintness, it should be remembered in *asthma*, *croup*, *pneumonia*, *bronchitis*, and *bronchorrhœa.* It is particularly valuable in the *bronchial catarrh* of the young and of the enfeebled and debilitated old.

Some practitioners pretend to have cured many chronic diseases by the administration of minute doses of tartar emetic, repeated 3 or 4 times daily. It was formerly often used in the form of lotion, liniment, ointment, or plaster, as a counter-irritant in many painful, deep-seated, and chronic maladies. A drachm of tartar emetic to 4 drachms of lard for an ointment, or, dissolved in 1½ fluid ounces of water as a wash. Not unfrequently the external application of tartar emetic gives rise to *obstinate ulcers*, sometimes of a gangrenous character, and in some cases severe and fatal constitutional disorder has resulted.

It must be borne in mind that to accomplish specific results with this agent, the dose must be minute. It is generally preferred in homœopathic trituration—2x trituration for adults; 3x trituration for children—of which about 2 grains should be given every 2 hours.

Specific Indications and Uses.—Sub-acute bronchial inflammation; cough, rattling (sometimes hollow and reverberating), with loud, fine, subcrepitant rales; hoarseness, with tenderness of the larynx; capillary bronchitis; feeble cough of the aged, with free secretion and lack of power to expectorate.

ANTIMONII OXIDUM (U. S. P.)—ANTIMONY OXIDE.

FORMULA: Sb_2O_3. MOLECULAR WEIGHT: 287.08.

SYNONYMS: *Antimony trioxide*, *Antimonous oxide*, *Oxydum stibicum*, *Oxydum antimonicum*, *Stibium oxydatum.*

History.—Under the name *Flores antimonii* (*flowers of antimony*, or the *Argentine flowers of antimony*), this substance was known to the alchemists since the time of Basil Valentine. It was first procured by roasting the sulphide, but afterward by burning metallic antimony in the air. This oxide constitutes *white antimony* or the ore known as *valentinite;* a compound consisting of this oxide and antimonic oxide forms *cervantite* or *antimony ochre.* A large deposit of this ore is also to be found in the district of Sonora, Mexico (*Amer. Jour. Pharm.*, 1881). Antimony oxide is mostly used as a substitute for white lead in painting.

Preparation.—"Take of solution of chloride of antimony, 16 fluid ounces; carbonate of sodium, 6 ounces (av.); water, 2 gallons (Imp.); distilled water, a sufficiency. Pour the antimonial solution into the water, mix thoroughly, let the precipitate settle, remove the supernatant liquid by a siphon, add 1 gallon of distilled water, agitate well, let the precipitate subside, again withdraw the fluid, and repeat the processes of affusion of distilled water, agitation, and subsidence. Add now the carbonate of sodium previously dissolved in 2 pints of distilled water, leave them in contact for half an hour, stirring frequently; collect the deposit on a calico filter, and wash with boiling distilled water until the washings cease to give a precipitate with a solution of nitrate of silver acidulated by nitric acid. Lastly, dry the product at a temperature not exceeding 100° C. (212° F.)"—(*Br. Ph.*).

The *U. S. P.* (1870) process differed from the above chiefly in the agents employed, the chloride being first prepared by digesting 4 parts of black sulphide of antimony and 18 parts of hydrochloric acid: $Sb_2S_3+6HCl=2SbCl_3+3H_2S$. The hydrogen sulphide escapes for the most part, while the antimonous chloride remains in solution. The use of nitric acid was also directed in the *U. S. P.* process, the object being to oxidize what little hydrogen sulphide would remain in the liquid. The aqueous solution of antimony terchloride thus formed is now diluted, whereby antimonous oxychloride ($2SbCl_3.5Sb_2O_3$), or *powder of Algaroth*, is precipitated. This, when washed with water, is deprived of a portion of its chlorine combined as hydrochloric acid, leaving a still more basic oxychloride. Next by means of an alkali (ammonia, *U. S. P.*, 1870) or alkaline carbonate (sodium carbonate, *Br. Ph.*), the oxychloride is converted into an antimonous oxide, and, to prevent the formation of the higher oxides, is dried at a low heat. The process should be conducted under a flue to carry off the deleterious gases.

Description and Tests.—"A heavy, grayish-white powder, without odor or taste, and permanent in the air. Almost insoluble in water, and insoluble in alcohol. Nitric acid fails to dissolve it, but it is readily soluble in hydrochloric acid without effervescence, and also in a warm solution of tartaric acid, or in a boiling solution of potassium bitartrate. When heated, the oxide turns yellow, becoming white again on cooling, and at a dull-red heat fuses to a yellowish liquid, which concretes, on cooling, to a crystalline mass of a pearly color. At a higher temperature, it sublimes, producing colorless and transparent, or white, shining, needle-shaped crystals"—(*U. S. P.*). The tetroxide, known also as *antimonous-antimonic oxide* (Sb_2O_4 or $Sb_2O_3.Sb_2O_5$), is formed when the antimonous oxide is slowly heated in the air.

"On dropping its solution in hydrochloric acid into water, a white precipitate is produced, which is at once changed to orange by hydrogen sulphide T.S. If 1 Gm. of the oxide be dissolved with the aid of 5 Gm. of tartaric acid in a little water, and the solution diluted with water to the measure of 100 Cc., portions of this solution should not be affected by test-solutions of silver nitrate (absence of chloride), barium chloride (sulphate), or potassium ferrocyanide (iron and other metals). If a solution of the oxide in hydrochloric acid be diluted with water, until it just begins to become permanently turbid, and then precipitated with hydrogen sulphide, this precipitate, when collected and thoroughly washed, should be completely soluble in ammonium sulphide T.S. (absence of copper and lead). If 1 Gm. of the oxide be dissolved in hydrochloric acid, and to this solution 1 Cc. of stannous chloride T.S. (see *List of Reagents*, Bettendorff's Test for Arsenic) be added, together with a small piece of pure tin-foil, no turbidity or coloration should ensue within 1 hour (limit of arsenic)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This product is seldom used in medicine, and never by Eclectic practitioners. Owing to its comparative insolubility, it is less nauseating and less apt to provoke emesis than the other antimonials, which in the main it resembles in action. Dose: 2 to 4 grains. This article is generally employed in the preparation of the various medicinal salts of antimony. It has been occasionally used as a sedative, in doses of from 1 to 10 grains, though its action is uncertain, being sometimes inert, and again causing violent emesis.

ANTIMONII SULPHIDUM (U. S. P.)—ANTIMONY SULPHIDE.

FORMULA: Sb_2S_3. MOLECULAR WEIGHT: 335.14.

"Native antimony sulphide, purified by fusion, and as free from arsenic as possible"—(*U. S. P.*).

SYNONYMS: *Antimony trisulphide*, *Antimonous sulphide*, *Black* or *Crude antimony*, *Antimonium crudum*, *Sulfuretum stibicum*, *Antimonii sulphuretum* (*U. S. P.*, 1870), *Antimonium nigrum* (*Br.*, 1867).

Source and History.—Under the name *stimmi*, the ancients employed this metallic compound as a cosmetic and topical remedy for skin diseases. It is found in Europe (chiefly in Germany and France), Nevada and Arkansas, New Brunswick and Borneo, as an ore denominated *stibnite*, and is usually associated with galena, quartz, heavy spar, calc spar, and iron pyrites. It is separated by melting it, after which, it is run into earthen receivers, cooled, and powdered. This is called *crude antimony*, which name should not be confused with that for metallic antimony. Crude antimony usually contains iron sulphide, and traces of the sulphides of lead, copper, and arsenic. Powdered coal, chalk, and marble, are frequently found as adulterants.

Description and Tests.—Before powdering and purifying, crude antimony usually has the shape of the conical vessels in which it has cooled. Outside it is blackish, but when broken, exhibits a crystalline, needle-like appearance, of a blue-gray or steel-like lustre. Its density ranges from 4.5 to 4.7. When drawn across a white object it leaves a black mark upon it. Officially it is described as in "steel-gray masses of a metallic lustre, and a striated, crystalline fracture, forming a black or grayish-black, lustreless powder, without odor or taste, and permanent in the air. Insoluble in water or alcohol, but soluble in hydrochloric acid with the evolution of hydrogen sulphide. At a temperature below a red heat, the sulphide fuses to a dark-brown liquid. If 1 Gm. of the powdered sulphide be digested and finally boiled with 10 Cc. of hydrochloric acid, it should dissolve without leaving more than 1 per cent of residue. This acid solution, completely deprived of hydrogen sulphide by boiling, yields, when added to water, a white precipitate which is soluble in a solution of tartaric acid. After the separation of the precipitate by filtration, the filtrate yields an orange-red precipitate with hydrogen sulphide T.S."—(*U. S. P.*). Antimony trisulphide occurs in amorphous form when precipitated from solutions (see *Antimonium Sulphuratum*).

It may be distinguished from coal dust by the failure of the latter to dissolve in hydrochloric acid, while marble or chalk effervesce when in contact with hydrochloric acid. An ounce bottle, dry and tared, will hold, when well shaken down, 2¼ ounces of antimony sulphide, and but 1¼ ounces of coal dust (*Proc. Am. Pharm. Assoc.*, 1885). By purification, the object of which is to deprive it as much as possible of admixed arsenous sulphide, crude (sulphide of) antimony yields the official

ANTIMONII SULPHIDUM PURIFICATUM (*U. S. P.*)—*Purified antimony sulphide*, *Purified antimony trisulphide.* Sb_2S_3=335.14.

Purification.—"Antimony sulphide, one hundred grammes (100 Gm.) [3 oz. av., 231 grs.]; ammonia water, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏︎]; water, a sufficient quantity. Reduce the antimony sulphide to a very fine powder. Separate the coarser particles by elutriation, and, when the finely divided sulphide has been deposited, pour off the water, add the ammonia water, and macerate for 5 days in a well-closed vessel, agitating the mixture frequently. Then let the powder settle, pour off the ammonia water, and wash the residue by repeated affusion and decantation of water. Finally dry the product by the aid of a gentle heat"—(*U. S. P.*).

Description and Tests.—"A heavy, grayish-black, lustreless powder, without odor or taste, and permanent in the air. Insoluble in water or alcohol, but soluble in hydrochloric acid with the evolution of hydrogen sulphide. At a temperature below a red heat, it fuses to a dark-brown liquid. If 1 Gm. of the sulphide be digested, and finally boiled, with 10 Cc. of hydrochloric acid, it should dissolve without leaving more than 1 per cent of residue. This acid solution, completely deprived of hydrogen sulphide by boiling, yields, when added to water, a white precipitate, which is soluble in a solution of tartaric acid. After the separation of the precipitation by filtration, the filtrate yields an orange-red precipitate with hydrogen sulphide T.S. If 2 Gm. of the sulphide be mixed and cautiously ignited, in a porcelain crucible, with 8 Gm. of pure sodium nitrate, and, after cooling, the fused mass be boiled with 25 Cc. of water, there will remain a residue which should be white or nearly so, and not yellowish nor brownish (absence of other metallic sulphides). On boiling the filtrate separated from the last-mentioned residue with a slight excess of nitric acid, until no more nitrous vapors are evolved, then dissolving in it 0.1 Gm. of silver nitrate, filtering again, if necessary, and cautiously pouring a few drops of ammonia water on top, not more than a white cloud, but no red or reddish precipitate should appear at the line of contact of the two liquids (absence of more than about 0.1 per cent of arsenic)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Action, that of the antimony compounds in general. It was formerly combined with drastic purgatives. It is very seldom used in medicine at the present day. Dose: 5 to 15 grains.

Antimony and Its Compounds.—ANTIMONIUM, *Antimony, Stibium.* Symbol: Sb. Atomic Weight: 120. Many minerals contain antimony, but the chief and almost only source of the commercial product is the native trisulphide of antimony (Sb_2S_3)—the ore *stibnite.* Though known at a very early time, it was first separated by the monk Basilius Valentinus. The bulk of antimony comes from France and Germany, though other places also furnish it. France furnishes the best product, which is in plano-convex circular cakes packed in casks. Spanish antimony is formed into pigs; the English into cones. Iron, lead, and arsenic are always present. To obtain the metal, stibnite is melted and the fused sulphide roasted in contact with the air to crude oxide of antimony. It is then intermixed with powdered charcoal previously saturated with solution of sodium carbonate, and roasted. Or, metallic iron and purified sulphide of antimony are fused together, iron sulphide and metallic antimony resulting. The product is then run into molds. Antimony is a crystalline mass of hard, brittle, silver-white metal, having a density of 6.7 or 6.8. It is unaffected by cold air, but when heated in the atmosphere, oxidizes, and heated in the presence of a current of hydrogen, volatilizes. It is not affected by cold, diluted sulphuric acid; hot sulphuric acid forms with it a sulphate; hot hydrochloric and cold nitrohydrochloric acids dissolve it. The elements of the sulphur and chlorine groups, and phosphorus and arsenic, combine with it directly. Some alloys are prepared with antimony, *e.g.*, type metal. The *antimony black* (not *black antimony*) employed to give a steel-like polish to casts and patterns, is a form of metallic antimony produced by precipitating the solution of the trichloride with zinc. Antimony forms three oxides, viz.: antimony trioxide (Sb_2O_3), antimony tetroxide (Sb_2O_4), and antimony pentoxide (Sb_2O_5), the last two of which are not employed in medicine. Antimony teroxide is *antimonous oxide*, and forms with water, *antimonous acid*, the salts being known as *antimonites;* antimony tetroxide is also known as *antimonous-antimonic oxide* (Sb_2O_4 or $Sb_2O_3.Sb_2O_5$); antimony pentoxide is *antimonic oxide*, producing with water, *antimonic acid*, a lemon-yellow powder, the salts of which are the *antimonates. Antimony ash* (*cinis antimonii*) is an impure tetroxide produced by gradually heating to redness the black sulphide in contact with the air; if this ash be fused with a little black antimony it forms *antimonial glass* (*vitrum antimonii*) a garnet-red, transparent mass. *Liver of antimony* (*hepar antimonii*) is formed when small amounts of potassium nitrate and black antimony (equal parts) are ignited and when the resulting potassium sulphate and sulphantimonate are removed from it by exhausting with water, *crocus of antimony* (a mixture of oxide and sulphide chiefly) remains. *Diaphoretic antimony* (*antimonium diaphoreticum*) is prepared like liver of antimony, excepting that twice the quantity of nitrate potassium is employed. It contains antimony oxide, sulphate, antimonate and nitrate and nitrite of potassium in variable amounts. Metallic antimony may be recognized by dissolving it in aqua regia and evaporating off the solvent. When the residue is dissolved in hydrochloric acid, precipitates are obtained with water (oxychloride, soluble in tartaric acid), with hydrogen sulphide gas (Sb_2S_5, orange-red antimonic sulphide), or the liquid may be subjected to Marsh's test (see *Acidum Arsenosum*).

ANTIMONII IODIDUM (SbI_3).—*Antimony iodide, Teriodide of antimony.* A dark, orange-red powder, yielded upon pulverizing the foliated crystalline mass produced by gently heating together in a Florentine flask, 3 parts of iodine and 1 part of metallic antimony, and allowing the product to cool. Water decomposes it. Dose: $\frac{1}{4}$ to 1 grain in pill as an alterative.

ANTIMONII ARSENAS.—*Antimony arsenate.* A snowy-white, heavy powder, employed in certain portions of Europe (Russia) as an alterative in doses of $\frac{1}{50}$ grain 4 times a day. It is composed nearly half (44 per cent) of arsenic acid.

ANTIMONII TRICHLORIDUM ($SbCl_3$).—*Antimony trichloride, Antimony terchloride, Butter* or *oil of antimony, Muriate of antimony, Sesquichloride of antimony.* As formerly prepared by placing in a glass retort 3 parts of pure metallic antimony and 8 parts of mercuric chloride, and gradually heating, butter of antimony was produced, subliming and condensing in the neck of the retort as a white, thick, unctuous, semitransparent, inodorous substance, having a very caustic taste. Soubeiran prepared it by dissolving, with the aid of a gentle heat, 1 part of sulphide of antimony and 5 parts of hydrochloric acid, allowing the mixture to stand, and then decanting off the clear fluid, evaporating, and distilling almost to dryness. As obtained by these processes, butter of antimony is decomposed by water, and attracts moisture from the air and becomes yellow. It melts at 100° C. (212° F.) and volatilizes a little above this temperature, forming on cooling, tetrahedral prisms. The "butter of antimony" of the present day is a reddish solution produced by dissolving antimony trisulphide, 1 part, in hydrochloric acid, 4 parts, employing heat, filtering, and evaporating to 2 parts. Its color is due to iron and other metallic impurities, and the solution when distilled is a colorless solution of $SbCl_3$ (see *Liquor Antimonii Chloridi—Br.*).

ANTIMONIUM SULPHURATUM (U. S. P.)—SULPHURATED ANTIMONY.

"Chiefly antimony trisulphide ($Sb_2S_3=335.14$); with a very small amount of antimony trioxide"—(*U. S. P.*).

Synonyms: *Kermes mineral*, *Antimonii sulphuretum præcipitatum* (*Dub.*), *Antimonii oxysulphuretum* (*Lond.*), *Antimonii sulphuretum aureum*.

Source and History.—The monk, Basil Valentine, seems to have been the first to obtain what was subsequently known as *golden sulphur* (*sulphur auratum* of Quercetanus, 1603), and *antimonial kermes* (*kermes minerale* of Simon, 1719). Glauber had, however, already prepared the latter substance by making a hot solution of black antimony in potassa and cooling the product. Rose, in 1825, and Fuchs, in 1833, made clear the fact that Kermes mineral was nothing else than amorphous antimony sulphide (R. & S.). All the processes—and they were numerous—result in producing a mixture of one or the two sulphides of antimony and some oxide of antimony. That of the *U. S. P.* is an almost pure antimony trisulphide (Sb_2S_3). That of the *German Pharmacopœia* is pure antimony pentasulphide (Sb_2S_5).

This preparation, though official under the name *Kermes mineral*, is not the original mixture of that name (a description of which will be found below under *Related Compounds*). There are three preparations of sulphur and antimony: (1) an *amorphous precipitated antimony sulphide* (Sb_2S_3), orange-red in color; (2) a mixture containing some antimonous oxide known as *Kermes mineral* ($[Sb_2S_3]_2+SB_2O_3$), of a red-brown color; (3) and antimonic sulphide (antimony pentasulphide), (Sb_2S_5), known as *golden sulphur* or *golden sulphide of antimony*.

Preparation.—"Purified antimony sulphide, one hundred grammes (100 Gm.) [3 oz. av., 231 grains]; solution of soda, twelve hundred cubic centimeters (1200 Cc.) [40 fl℥, 277 ♏]; distilled water, diluted sulphuric acid, each, a sufficient quantity. Mix the purified antimony sulphide with the solution of soda and three thousand cubic centimeters (3000 Cc.) [91 fl℥, 203 ♏] of distilled water, and boil the mixture over a gentle fire for 2 hours, with frequent stirring, and occasionally adding distilled water so as to preserve the same volume. Strain the liquid immediately through a double muslin strainer, and drop into it while yet hot, diluted sulphuric acid, so long as it produces a precipitate. Wash the precipitate with hot distilled water until the washings are at most but very slightly clouded by barium chloride T.S.; then dry the precipitate at a temperature not exceeding 25° C. (77° F.), and rub it to a fine powder. Keep the product in well-stoppered bottles, protected from light"—(*U. S. P.*).

Crystallized antimony sulphide requires the aid of heat to dissolve it in alkaline fluids. The amorphous form dissolves in cold solutions. Such a solution (soda), as directed in the official process, contains sodium meta-antimonite ($NaSbO_2$) and sodium sulphantimonite (Na_3SbS_3), according to the following equation: $Sb_2S_3+4NaOH=Sb_2S_3Na_3+SbO_2Na$. These bodies are decomposed upon the addition of the sulphuric acid, whereby antimonous sulphide precipitates, thus: $Na_3SbS_3+NaSbO_2+2H_2SO_4=2Na_2SO_4+Sb_2S_3+2H_2O$. The reaction does not take place quantitatively in this manner, as some hydrogen sulphide is liable to escape, resulting from the action of the acid upon the sulphantimonite. Consequently some undecomposed antimonite is precipitated with the sulphide. The official directions should be closely followed to insure, as nearly as possible, uniform results. Atmospheric exposure and state of concentration of the alkali solution, affect the composition of the product.

Description and Tests.—"An amorphous, reddish-brown powder, becoming lighter in color on exposure to light, and having neither odor nor taste. Insoluble in water or alcohol, but soluble in hydrochloric acid with the evolution of hydrogen sulphide. When heated in a dry test tube, it emits moisture and leaves a black residue. If 1 Gm. of sulphurated antimony be gently heated with 10 Cc. of hydrochloric acid, it should dissolve, with the exception of a slight residue, which, when washed and dried, should burn on the application of a flame, with the characteristic odor of sulphur, leaving not more than a scanty ash. The acid solution, completely deprived of hydrogen sulphide by boiling, yields, when added to water, a white precipitate, which, after being washed and dried, should weigh not less than 85 per cent of the original weight of the sulphide. The liquid filtered from this precipitate yields an orange-red precipitate with hydrogen sulphide T.S. If 1 Gm. of sulphurated antimony be shaken with 20 Cc. of hot water, the filtrate should be neutral to test paper, should not be rendered more than slightly opalescent by barium chloride T.S. (limit of sulphate), or silver nitrate T.S. (limit of chloride), and should not be affected by ammonium oxalate T.S. (absence of calcium). When tested for arsenic, as described under purified antimony sulphide, it should afford no reaction beyond the limit prescribed for the latter"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This agent is not used in Eclectic medicine. It possesses the qualities of antimonials in general, and is administered in from 1 to 2 grain doses as an alterative, and in from 5 to 20 grains as an emetic.

Related Compounds.—ANTIMONII OXYSULPHURETUM (*U. S. P.*, 1870). *Oxysulphuret of antimony, Kermes mineral.* This preparation was formerly official. It is prepared by the *dry process* by heating in a crucible 2 parts of antimony trisulphide and 1 part of potassium hydroxide; pulverize the mass thus obtained, and boil it with 10 or 12 parts of water; filter the liquor while boiling, and the kermes precipitates on cooling. In the *humid way* it is prepared by boiling for ½ hour 1 part of finely powdered sulphide of antimony, 22.5 parts of crystallized carbonate of sodium, and 250 parts of water; kermes precipitates likewise on cooling. The last mode gives a finer article, preferred to that by the former process. It is a reddish-brown powder with a tinge of purple, of a velvety appearance, light, inodorous, of a slowly-developed, metallic taste, and insoluble in water or alcohol. Hot hydrochloric acid dissolves it, hydrogen sulphide being evolved. Exposed to air or light, it loses its red color and velvety aspect. It is completely soluble in ammonium sulphide. Heated to a red heat with charcoal, it is converted into metallic antimony. It is a mixture of Sb_2S_3 and Sb_2O_3. Kermes mineral, in doses of from 6 to 10 grains, is an emetic, but its action is uncertain. In smaller doses, say from ¼ grain to 1 or 2 grains, in mucilage, it is a stimulant, expectorant, nauseant, and diaphoretic, and was formerly employed in the last stage of "*peripneumonia*" (pneumonia), in *chronic catarrhs, humid asthma, cutaneous diseases, gout, rheumatism*, etc.; it is seldom used in this country except among German practitioners. It should have no place in therapy.

ANTIMONII PENTASULPHIDUM (Sb_2S_5), *Antimony sulphide. Golden sulphur, Golden sulphuret of antimony. Sulphur stibiatum aurantiacum, Sulphur auratum antimonii.*—As originally prepared, by boiling antimony sulphide in caustic potash solution and adding sulphuric acid, a golden-red powder was obtained, containing Sb_2S_5, with some Sb_2S_3 and Sb_2O_3. The *German Pharmacopœia* directs a pure pentasulphide instead of this mixture. Boil a solution of crystallized sodium carbonate (70), in water (250); mix with a milk prepared from lime (26) and water (80). Add washed antimony sulphide (36) and sublimed sulphur (7); boil until no longer of a gray color, filter and crystallize. These crystals (24 parts) having the composition $Na_3SbS_4.9H_2O$, and known as *Schlippe's salt*, are dissolved in water (700) and added to a solution of sulphuric acid (9) in water (200). The pure salt (Sb_2S_5) precipitates, and is washed and dried. A tasteless, odorless, orange-colored powder, which when sublimed evolves sulphur, leaving behind black antimonous sulphide. It wholly volatilizes at a red heat. It is not now employed medicinally. It was formerly used as an alterative in *chronic affections of the skin, rheumatism, secondary venereal diseases*, and *chronic hepatitis;* it is one of the constituents of Plummer's Alterative Pill. The dose is from 1 to 3 grains every 6 hours; when over 5 grains, the dose will be apt to occasion emesis.

ANTIPYRINUM.—ANTIPYRINE.

FORMULA: $C_6H_5N.CO.CH{:}CCH_3NCH_3.=(C_{11}H_{12}N_2O.)$.

MOLECULAR WEIGHT: 187.65.

SYNONYMS: *Analgesin, Antipyrin(e), Methosin(e), Methozine, Phenazone, Phenazon, Analgesine, Dimethyl-oxyquinizine, Phenyldimethylpyrazolon, Dehydrodimethylphenypyrazine, Phenazonum* (*Br.*).

A compound derived from coal-tar or prepared synthetically. "A crystalline substance obtainable from phenylhydrazine"—(*Br.*).

Source and Preparation.—Knorr first produced this compound in 1883. The original way of preparing it is as follows: Phenylhydrazine ($C_6H_5HN.NH_2$) is allowed to react, in the cold, upon aceto-acetic ether ($CH_3.CO.CH_2.COOC_2H_5$), whereby water is displaced and phenylhydrazine aceto-acetic ether is formed. This oily product heated to 100° C. (212° F.) evolves alcohol, leaving behind phenylmethylpyrazolon, formerly called *methyloxychinizin* ($C_{10}H_{10}N_2O$). This body is then changed into phenyldimethyl-pyrazolon iodide by heating it with methyl iodide in contact with methylic alcohol. It is then treated with sulphurous acid solution until decolorized, the alcohol separated by distillation, the residue treated with concentrated soda solution, and the heavy, oily base, after solidification, recrystallized from ether or toluene. By a patented process of 1890, antipyrine is made by the action of phenylhydrazine upon a compound ether; *e. g.*, ethyl-ether of beta-bromo, or chlorobutyric acid. It was demonstrated by Lederer, in 1891, that this process does not yield antipyrine, but an isomer. Antipyrine has also been prepared (1892) from the interaction of phenylhydrazine and crotonic acid (Knorr and Duden). Various processes of similar principle have been patented subsequently to obtain pyrazolon derivatives; *e g.*, by the interaction of beta- chlor-lactic acid and phenylhydrazine (Pfleger and Krauth, 1893).

Description.—Antipyrine usually occurs as crystalline laminæ, or when crystallized from water as prismatic crystals. As found in trade it forms a white, reddish-white, or whitish powder, having a taste mildly bitter, and scarcely any odor. It dissolves very readily in water, alcohol, chloroform, and benzene, less soluble in ether (about 1 in 50), and scarcely at all in benzin and carbon disulphide. It fuses at 113° C. (235.4° F.). It completely volatilizes by heat, but not without decomposition. Its solution in water is neutral to litmus, and should not respond to hydrogen sulphide, but precipitates with most alkaloid-test reagents, corrosive sublimate, basic acetate of lead, and Fehling's Test Solution, which latter is reduced by it. A characteristic reaction for antipyrine consists in the formation of green crystals of nitroso-antipyrine, when antipyrine, together with one-third its weight of sodium nitrite, is dissolved in about 8 times its weight of water, and a few drops of diluted acetic acid are added, and allowed to stand for 1 hour. The same reaction takes place with sweet spirit of nitre containing free acid (Flückiger and Nagelvoort). In dilute solution (about 1 in 20,000) merely a green coloration is formed, which deepens with the quantity of antipyrine employed. M. T. Schaak (1894) has proposed a method of determining antipyrine quantitatively by means of this reaction. A concentrated solution of antipyrine turns deep red by the addition of an acid-free solution of ferric chloride. The color disappears or turns light yellow with sulphuric acid. Antipyrine gradually decolorizes wine. By the direct contact of acids, salts are formed, showing this body to be a pronounced base. When first obtained it was erroneously supposed to be a derivative of quinoline. It is incompatible with solutions of amyl nitrite, hydrocyanic acid, spirit of nitrous ether (sweet spirit of nitre), chloral hydrate, salicylate and bicarbonate of sodium, carbolic acid, tannic acid, etc. It may be combined with aromatic syrups for administration.

Action and Toxicology.—Antipyrine is an extremely uncertain agent in its effects. Even small doses have occasioned alarming symptoms, a peculiarity being a characteristic livid hue of the countenance, which is attended with symptoms of collapse. As small a quantity as 3½ grains has produced death, while on the other hand a woman survived 1 ounce at one dose, and another consumed 1½ ounces in five days, the former with no other damage than a half-day's unconsciousness, and the latter swollen extremities and cyanosis. The usual symptoms from physiological doses are a languid and uneasy feeling, rise of temperature, peculiar cyanotic countenance, dyspnœa, hysterical phenomena, and often a rubeoloid eruption lasting about five days, followed by slight desquamation. The eruption sometimes assumes an erythematous character, or severe urticaria, or dermatitis, with œdema, or watery blebs and bloody blisters may follow its use. Even in doses regarded medicinal, it has occasioned coldness, copious sweating, irregular heart action, vomiting, and other symptoms of depression, bordering on collapse. Occasional symptoms are stomatitis, laryngeal complications, amaurosis, tinnitus, violent cough, coryza, burning in the mouth and fauces, metallic taste, gastro-enteritis, and mental dullness. More rarely general neuralgic pains, vomiting, diarrhœa, dysuria, convulsions, paralysis, and sopor are its effects. A toxic dose presents vertigo and tremors, distressing head-symptoms, increased pulsation, profuse sweating, reduction of temperature, oppressed respiration, exaggerated reflexes, somnolence, coma, profound insensibility, stertor, pupillary dilatation, convulsions, and death.

The reduction of temperature, which is marked in febrile states, has been shown to be independent of the profuse sweating produced. The reduction occurs whether sweating be present, or when it is prevented by such agents as atropine. The action of antipyrine, in toxic doses, upon the brain, is first to stimulate and then to depress; the spinal nerves are paralyzed, and the respiratory centers first stimulated and finally depressed and paralyzed. Blood-pressure is increased by large doses and depressed by lethal doses. Doses short of toxic have, as a rule, but little physiological effect upon the respiratory organs. The urinary secretion is markedly diminished by antipyrine, though this is the channel by which it is principally eliminated, the drug appearing in the urine within 30 minutes after being administered. It has been detected in human milk, and may therefore affect nursing infants. The teeth are said to be colored by this agent. Symptoms of collapse from antipyrine should be met by alcoholic stimulants and by the subcutaneous use of atropine sulphate.

Medical Uses and Dosage.—Antipyrine has been used as an analgesic, nerve sedative, antispasmodic, antipyretic, local anæsthetic, topical hemostatic, antigalactagogue, and to restrain secretions from the kidneys and bowels. Its chief value is in its power to control pain and spasm. It markedly reduces temperature in *febrile states*, but the preponderance of fast-accumulating evidence, even in the old school where it has been so largely and so fatally used, shows it to be wholly undesirable as an antipyretic. While its power to reduce temperature is undisputed, it is well known that it does not, in the least, shorten the course of any of the febrile disorders, and is open to the serious objection of favoring depression and collapse, and tends to increase the difficulty upon which many fevers depend in causing the retention in the system of morbific products, whose elimination is prevented by its restraining power over renal activity. There are a few febrile complaints in which it does apparent good. These are *surgical fever* after operations and *puerperal septicæmia*, with intensely high temperature. Here it should be employed to reduce the temperature somewhat, but it must not be carried too far. In the high temperature of respiratory lesions it is said to be of some value, as in *pneumonia* and *pleurisy*. It has no action upon the diseased structure, except to relieve pain and lower temperature. Undoubtedly, the majority of cases of "heart failure," which have been reported in the past few years, are due more to the indiscriminate use of this and other coal-tar derivatives than to any other agency. Antipyrine has been used to control the febrile phenomena of *phthisis*, but the unpleasant and debilitating sweating produced more than overbalances the good it may do. *Thermic fever* (congestive form) from *sun-stroke* and not that from heat exhaustion, is said to be benefited by it. *Diarrhœa*, *diabetes mellitis* and *insipidus*, and other excessive secretions, except of the skin, have been restrained by its use. *Epilepsy*, purely functional, *tetanus*, *asthma*, and other *spasmodic disorders*, have been treated by it with both success and failure. *Chorea* and *whooping-cough*, however, seem to be more amenable to it, and it is accredited with shortening the duration of the latter disease.

In painful and spasmodic disorders it will find its best field of action. Its use in *migraine* and other forms of *headache*, especially of neuralgic character, is well known. However, much danger attends its constant employment, as prolonged prostration and debility have followed such use. Webster believes it to be cumulative (*Dynam. Ther.*, 115). It is used largely to control *pain* in *sciatica*, *tetanus*, *dysmenorrhœa*, *gravel*, *locomotor ataxia*, *neuritis*, *rheumatism* (muscular and articular), *arthritis* (rheumatic), *gout*, *angina pectoris*, *renal* and *hepatic colic*, *syphilis*, *neuralgia of zona*, *after-pains*, and to allay *itching* and *burning pain of cutaneous disorders*. *Palpebral neuralgia*, *sclero-choroiditis*, *epischleritis*, *iritis*, *keratitis*, *irido-choroiditis*, *detached retina*, *pain after cataract operations*, *toxic amblyopia*, and *floating bodies* in the vitreous humor are among the eye affections in which it has been used, though it is not looked upon with special favor by our ophthalmologists. Locally it has been employed as an antiseptic dressing to *ulcers* to relieve pain, and as a local hemostatic.

The large doses formerly recommended—75 to 90 grains, and subsequently 15 to 50 grains—are seldom now given. The dose should not, at any time, exceed 20 grains, and 5 grains is about the best dose for average purposes. For young children give 1 grain every hour until 3 doses have been taken. It may be administered in mint water, aromatic syrup, or coffee. Subcutaneously, 5 grains is the safest maximum dose. It has also been given by enema and suppository.

Specific Indications and Uses.—Pain and spasm; high temperature in surgical and puerperal fevers; migraine.

Antipyrine Derivatives.—Iodopyrine. *Iodopyrin, Iodantipyrin.* This salt is prepared by mixing with an alcoholic solution of antipyrine a hot alcoholic solution of iodine, the iodine and antipyrine being present in such a proportion as to form a mono-iodide. When left standing a few days, iodopyrine crystallizes. If the proportion of iodine be twice the former, a diiodide of antipyrine is produced. Iodopyrine forms colorless, silky, acicular crystals, almost without taste or odor. It is practically insoluble in cold water, but dissolves freely in hot water. It fuses at 160° C. (320° F.). This agent sometimes occasions copious diaphoresis, and is antipyretic, though it does not shorten the period of febrile diseases. Dose, 1 to 4 grains.

Bromopyrine.—*Monobromantipyrin* ($C_{11}H_{11}BrN_2O$). White acicular crystals, which melt at 114° C. (237.2° F.). Scarcely soluble in water, hot or cold, but dissolves easily in chloroform and alcohol. Its action has not yet been determined.

Benzopyrine.—*Benzoate of antipyrine.* Add antipyrine to a solution of benzoic acid at 100° C. (212° F.), below which point the resulting salt forms with the production of a yellow fluid, which congeals as a mass of opaque crystals. It is practically insoluble in water, while both ether and alcohol dissolve it.

Salipyrine.—*Salipyrazolon, Salazolon, Salicylate of antipyrine, Antipyrine salicylate.* A definite salt formed by the interaction of salicylic acid and antipyrine. It is prepared by heating together molecular quantities of the two named bodies. An oily fluid results, which solidifies when cool, and is then crystallized from alcoholic solution as a white salt, with a somewhat pleasant taste, but no odor. It is practically insoluble in water, is partially soluble in ether, and freely so in alcohol or benzene. It fuses at 91.5° C. (196.7° F.). Its solution is faintly acid, and the taste at first sweet, then bitterish. If prepared from solutions of salicylic acid in water and of antipyrine in ether it slowly deposits beautiful crystals, which dissolve in ether with difficulty. This agent is antipyretic, antirheumatic, and antineuralgic. Like antipyrine it may occasion an eruption, and sometimes acts as an emetic. It is eliminated by the kidneys. Dose, 5 to 15 grains, and not more than 40 grains should be administered in 24 hours.

Antipyrinum Amygdalicum.—*Tussol.* This substance was introduced in 1894 as a remedy for *whooping-cough*, and is obtained by fusing together 188 parts of antipyrine with 152 parts of mandelic acid, which proportion represents equimolecular quantities. The product forms bitter crystals, easily soluble in water. Alkaline liquids and milk decompose it. The doses vary from ¼ to 1½ grains for children less than 1 year, to be given 2 to 3 times a day; for children of 1 to 2 years of age, the dose is 1½ grains, to be given 3 times a day. The dose may be increased to 3¾ grains, or even 6 grains, 3 to 4 times a day for older children.

Phenopyrine. Equal amounts of antipyrine and pure carbolic acid (phenol), well dried, triturated together form phenopyrine. It is a colorless and inodorous, oily liquid, which crystallizes upon standing. Does not dissolve in cold water.

Picropyrine. Prepared by adding, drop by drop, a strong solution of antipyrine to a concentrated solution of picric acid in water. The resulting precipitate is then recrystallized from hot water. It forms fine acicular crystals of the characteristic yellow color of the picrates.

Naphthopyrine. *Beta-naphthol-antipyrine.* This product is the result of triturating antipyrine 1 part (by weight), with 2 parts of beta-naphthol. Is somewhat soluble in boiling water, soluble in ether and alcohol, but does not dissolve in cold water.

Pyrogallopyrine. Triturate together 1 part (by weight) of antipyrine, and 2 parts of pyrogallol. If the solutions of the two be mixed and allowed to stand a few hours pyrogallopyrine crystallizes in handsome prisms. Its solubility is like that of *naphthopyrine* (which see).

Resorcylalgin is a new antiseptic prepared in 1893 by the action of resorcylate of potassium upon antipyrine. It is little soluble in water, easily soluble in alcohol, has an acid reaction, and forms salts with alkalies. The ammonium salt is easily soluble.

Tolypyrin is a copyrighted name given to a homologue of antipyrine elaborated by H. Thoms in 1892. It is prepared by the action of paratolyl-hydrazine upon aceto-acetic ether. Its taste is bitter; it has a fusing point of 136° to 137° C. (276.8° to 278.6° F.), is soluble in 10 parts of water, in alcohol, almost insoluble in ether; with ferric chloride, or with nitrous acid it behaves like antipyrine. A specific reaction for tolypyrin is said to be as follows: If to a quantity of tolypyrin, about ½ to 1 gramme, be added, 2 Cc. of a 25 per cent solution of nitric acid, the liquid turns wine-red, and becomes light-yellow when ammonia is added.

Tolysal. *Tolypyrinum salicylicum* (1893), is said to be valuable as an antirheumatic, antineuralgic, and antipyretic agent.

Related Compounds.—Antithermin. *Phenyl-hydrazin-lævulinic acid* ($CH_3.C:[N_2HC_6H_5].CH_2.CH_2.COOH$). This compound precipitates when phenylhydrazine (108 parts) dissolved in acetic acid is mixed with a solution of lævulinic acid ($CH_3COCH_2CH_2.COOH.$) (116 parts), in water. By dissolving the resulting product in boiling water, and decolorizing with animal charcoal, it crystallizes as a colorless, lustrous salt, having scarcely any taste, and is very slightly soluble in alcohol and water. When heated to 170° C. (338° F.), it becomes phenylhydrazine lævulinic anhydride ($C_{11}H_{12}N_2O$). In 3 grain doses it is used in the febrile states of *pulmonary consumption* and *Bright's disease.*

Agathin.—*Salicylaldehyde alpha-methylphenylhydrazone* ($C_6H_4[OH].CH{=}N.N[CH_3].C_6H_5$). This salt results from the direct interaction of alpha-methylphenylhydrazine and salicyl-aldehyde. It forms greenish-white, crystalline plates which dissolve in ether and alcohol, but not in water. They are tasteless and odorless. It fuses at 74° C (165.2° F.). Antirheumatic and antineuralgic in 5 to 8 grain doses 3 times a day. No untoward results have been observed from its use.

Pyrazole ($C_3H_4N_2$, or $\left\{\begin{matrix}CH=N\\CH=CH\end{matrix}\right\}:NH$). Formed by acting upon hydrazine with epichlorhydrin in the presence of chloride of zinc. It forms in needles soluble in water, ether and alcohol. Of its derivatives, all of which paralyze the central nervous system (Tappeiner, 1891), *phenylmethylpyrazol carboxylic acid*, in daily doses of from 15 to 30 grains, is said to be an exceedingly active and harmless diuretic.

Migranin. Said to be a mixture of antipyrine (about 9 parts), caffeine (about 1 part), and a small portion of citric acid. Given in 15 grain doses for the relief of *migraine* and the *headache of la grippe*.

Aceto-ortho-toluid ($C_7H_7NH.C_2H_3O$). Needles, colorless, soluble readily in alcohol, ether, and hot water. Slightly tonic. Powerfully depresses temperature.

Antipyrine-Salol. Equal parts of salol and antipyrine fused together until of a brown color, remaining fluid when cool. Antiseptic, and applied by cotton tampons as a bemostatic in *hemorrhage* from the uterus (Coblentz).

APIS.—APIS.

The alcoholic tincture and the virus of *Apis mellifica*, Linné, the common honey-bee.

Class, Insecta; *Order*, Hymenoptera; *Family*, Apidæ.

Common Names: *Honey-bee*, *Hive-bee*.

History.—This well known bee inhabits the wilds in swarms, and is also kept in proper establishments for the purpose of obtaining its honey and wax. The insect is too well known to need a description here.

Preparation.—I. Tinctura Apis Mellificæ, *Tincture of apis*. The preparation of apis generally employed is the alcoholic tincture, which, for general purposes, may be prepared as follows: Place a swarm of live bees in a large jar and then by shaking them excite their anger. When this is accomplished, cover them with deodorized alcohol and allow them to macerate a month; then decant and filter the liquid. The homœopathic tincture is prepared in the same manner by using 1 part of live bees to 5 parts of diluted alcohol, macerating 8 days, decanting, straining, and filtering. Diluted alcohol is also preferred for their dilutions of this preparation.

II. Apium Virus.—This form is used but little by Eclectics, but largely in homœopathy. It is obtained either by drawing the sting and poison-bag from a freshly killed bee, inserting the sting into a small glass tube, and by compressing the bag, squeezing the poison into it. Or, with a pair of forceps seize a live bee and allow it to grasp a small piece of sugar. It will at once sting into the lump which will absorb the virus. This is to be repeated until a sufficient amount is secured to start a trituration, which is prepared like other homœopathic triturations as stated under *Triturations*.

Action, Medical Uses, and Dosage.—This remedy had its origin as a medicine in the homœopathic school, but is now a general favorite among Eclectics for certain diseased conditions. Apis is diuretic, alterative, and diaphoretic. It specifically influences the urinary tract, small doses somewhat resembling cantharis in action, in removing irritation, and in larger doses, stimulating the renal organs and other portions of the urinary passages. The small dose may be employed if there be irritation, even though inflammation exists. Aconite, veratrum, and like agents, promote the action of apis, while ammonia and alcoholic liquors are antagonistic to it. It is specifically indicated where we have hot, burning, dry, itching surfaces; and where there is constant desire, but inability to urinate, the urine being dark-red in color. Apis is one of the most certain diuretics in the materia medica, and is of very great value in *suppression* and *retention of urine*, from atony. It may be used even when there is active inflammation: ℞ Specific apis, gtt. v; aqua, fl℥iv. Mix. Teaspoonful every hour; or use an infusion of from 15 to 20 bees in water, 1 pint, for the usual urinary difficulties indicated above. It is a very useful remedy for *urethral* and *cystic irritation*, with burning, stinging pain, and constant and annoying *tenesmus*. *Chronic nephritis* and *cystitis* are sometimes cured by it. It serves a good purpose in diseases of women characterized by heat and a sensation of burning, with pain in the bladder and urethra, and constant desire to pass water. These conditions are relieved by it quicker than by any other agent. In *menorrhagia*, *amenorrhœa*, and *leucorrhœa*, with acute congestion of the ovaries, or in simple *ovarian congestion*, the parts being tender and painful, apis often gives prompt relief. *Genital puffiness* with irritation, and *labial inflammation* of the same character, are cured by it. ℞ Specific apis, gtt. x; aqua, fl℥iv. Mix. Teaspoonful every 4 hours. Owing to its power of relieving *renal irritation* and *engorgement*, thereby increasing function, apis is an exceedingly useful agent in *anasarca*, *ascites*, and *hydrothorax*, provided the kidneys are in an active condition. For these troubles: ℞ Specific apis, gtt. v; aqua, fl℥iv. Mix. Teaspoonful every hour. It is particularly useful in *post-scarlatinal dropsy*. *Inflammatory sore mouth* is benefited and often cured by apis. *Sore throats*, of an œdematous character, having a uniformly spread puffiness, as if the submucous tissues were involved—the parts appearing as if stung by a bee—are relieved by apis. These conditions are frequently met with as a complication of *erysipelas* and in the *angina of scarlatina*. It is often a prompt remedy for *vesicular erysipelas*, and for all *subcutaneous inflammations*, with burning, stinging, tensive, and lancinating pains, and dermal irritation. We have no better agent for the treatment of *urticaria*, or "*hives*," with soreness and intense itching, than apis. Puffiness is a strong indication in cutaneous diseases, and in *traumatic injuries* of the subcutaneous areolar tissues, it is often indicated by this symptom. It is a good remedy in *rubeola* and *scarlatina*, the usual indications being present. That form of *rheumatism* having the peculiar symptoms otherwise indicating apis, will be found to respond oftentimes to this remedy. We have known of well authenticated cases, where individuals suffering from rheumatism have been cured of that complaint after having been severely stung by the hive-bee. We do not recommend this form of hypodermatic injection, but prescribe for rheumatic conditions with blanched puffiness, and the peculiar stinging pain, as follows: ℞ Specific apis, gtt. v; aqua, fl℥iv. Mix. Teaspoonful every 2 or 3 hours. Dose: Tincture of apis, $\frac{1}{2}$ to 5 drops; specific apis, $\frac{1}{10}$ to 2 drops. The larger doses in dropsies; the smaller, in cutaneous disorders, and in vesical irritation; infusion (12 to 20 bees, aqua, Oj), tablespoonful doses frequently.

Specific Indications and Uses.—Itching, with burning of the surface, especially of the gentalia or urinary passages (Scudder); hot, dry, burning, itching or stinging surface; puffiness of mucous tissues, with burning, stinging, or irritation, the parts appearing as if stung; hives; vesical and urethral irritation, with constant desire, but inability, to urinate, the urine being deep-red; puffiness of parts with tendency to œdema.

APOCYNUM U. S. P.)—APOCYNUM.

The root of *Apocynum cannabinum*, Linné, (*Apocynum hypericifolium*, Aiton), gathered in autumn after the leaves and fruit have matured.

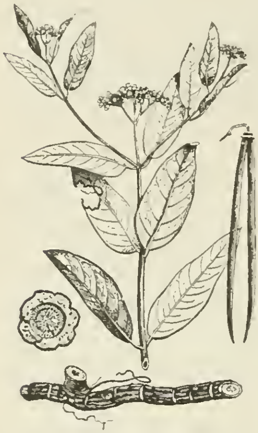
Nat. Ord.—Apocynaceæ.

COMMON NAMES: *Canadian hemp, Bitter root, Indian hemp.*

ILLUSTRATION: (See King's *American Dispensatory*, 8th ed., p. 114).

Botanical Source and History.—This is an erect, branching plant, from 2 to 4 feet high, which is found growing throughout the United States, on the borders of fields and in similar localities. The stem is covered with a strong fibrous bark, which is green when the plant grows in the shade, and of a reddish-brown color when in sunny localities, in which situations the plant is usually found. The fibrous bark was used by the Indians, and on this account, the name *Indian hemp* has been applied to this plant; but it is a bad term, as it has led to much confusion, from the fact that this is the common name for several other plants. The plant should *never* be designated by this name. The entire plant exudes a milky juice when wounded. The leaves are opposite, and attached to the stem at an acute angle. They exhibit considerable diversity of shape in plants that grow in different localities, and form several well-marked varieties; presenting, in the different varieties, modifications in outline from oblong to oval, with the bases of the leaves acute or subcordate. The most common form has oblong-lanceolate, veiny, entire leaves, on leaf-stalks, about $\frac{1}{4}$ of an inch long, and end in a short, mucronate point. The flowers are small, numerous, and in close, peduncled, flat cymes, which are shorter than the lateral branches. The calyx is small, with 5 narrow, sharp lobes; the corolla is 5-parted, with erect lobes, white or pale-red color, and but a little longer than the calyx. The stamens are 5, small, distinct, and included. The pistil has 2 ovaries covered by 2 united, sessile, fleshy stigmas. The fruit, which is produced by only a few of the flowers, consists of a pair of slender, diverging pods, containing numerous small seed, which are furnished with a bunch of silky, white hair at the apex (see Fig. 27). This plant, also erroneously called *Bowman's root* in Kentucky and some other sections of country, is indigenous, inhabiting the same locations and blossoming in the same months as the *A. androsæmifolium.* It is replete with a lactescent juice, which becomes hard, like opium, under exposure to the air. The bark of the stem, when dry, from its fibrous, cohesive nature, is a superior article in the manufacture of rope, giving a white, strong, and durable production. A permanent brown or black dye, according to the mordant used, is obtained from a decoction of the plant.

Fig. 27.



Apocynum cannabium.

The root of the plant is gathered by diggers and thrown upon the market under the names, *bitter root*, or *Indian hemp.* It is not to them known as the true *Apocynum cannabinum*, few of the diggers being aware that two species exist. Some writers have supposed that the roots of *A. cannabinum* and *A. androsæmifolium* are not to be distinguished from each other. Doubtless, such assertions have been made after having compared the roots sold upon the market under the foregoing names, in which case they are usually *identical*, being in almost every instance, obtained from the *Apocynum cannabinum.* There is, however, a marked difference both in the external appearance and the internal constitution of these two roots, and those who have compared authentic specimens can distinguish the two at a glance.

Description.—The root of *A. cannabinum*, gathered in the autumn and dried, is about ⅓ of an inch in diameter, wrinkled longitudinally, and marked by occasional transverse fractures through the bark, which show the white central portion. It consists of a bark, externally ash-gray in color, beneath which is a thin, brown, corky layer, and within this, the inner bark, which is of a pale-pink color. The remainder of the root is composed of white medullary matter, perforated by numerous longitudinal tubes, disposed more thickly in concentric circles about the fortieth of an inch apart, or forming a single circle. Radiating from the center are delicate medullary rays. When gathered in the spring, or in early summer, the center is pierced by a light pith, or a small cavity. The root, when dry, is brittle, and snaps readily, giving a clear, smooth fracture. As found in market, there are few, if any, fibers attached although, when fresh, the root is plentifully supplied with secondary roots; but as they are very brittle when dry, they do not long remain attached. We call attention to the exact engraving presented of the dry root, and also to a section of the root magnified (Fig. 27), and suggest that a comparison be made between these and those of *A. androsæmifolium* (Fig. 28). The woody portion of the root is slightly bitter; the bark is extremely bitter and disagreeable. It is described in the Pharmacopœia as follows: "Long, cylindrical, somewhat branched, 5 to 10 Mm. (⅕ to ⅖ inch) thick, gray or brownish-gray, longitudinally wrinkled and transversely fissured; brittle; fracture short, white; the bark rather thick; the wood porous, spongy, with delicate medullary rays; inodorous; taste bitter, disagreeable"—(*U. S. P.*). Water readily takes up the active properties of the root, which are also partially soluble in alcohol; its virtues are impaired by age.

Chemical Composition.—Dr. Griscom, who analyzed the root in 1832, found it to contain tannic and gallic acids, gum, resin, wax, fecula, *apocynin*, coloring matter, woody fiber, and, probably, caoutchouc. From the precipitate of the fluid extract, a white, waxy body without taste, and cane-sugar crystals were obtained by Prof. J. U. Lloyd in 1879. Two bodies having properties resembling those of digitalin were obtained, in 1883, by Schmiedeberg; one, *apocynin*, an amorphous principle, resinous, nearly insoluble in water, but readily dissolved by ether and alcohol; the other, *apocynëin*, a glucoside of a yellow color, dissolving freely in alcohol, but insoluble in ether, chloroform, and benzin. Boiling the former with chlorhydric acid renders it inert. Bromine and sulphuric acid give no test reaction with either of these bodies.

Action, Medical Uses, and Dosage.—Dr. Griscom states that this agent has four different and distinct operations upon the system, which it almost invariably produces, viz.: (1st) nausea or vomiting; (2d) this is followed by increased alvine discharges, which are succeeded (3d) by copious perspiration, and in many instances (4th) by diuresis. In full doses it occasions considerable sickness at the stomach, lessens the pulse, and produces an inclination to sleep, probably from some somniferous principle in it—copious vomiting soon ensues, and the other effects as above stated. Snuffed into the nostrils, the powder will excite sneezing. In diaphoretic doses it has proved beneficial in *intermittent* and *remittent fevers*, and *pneumonic affections*. A strong decoction in doses of a teaspoonful every 1, 2, or 4 hours, is exceedingly valuable in *irritable and congested uterus*, accompanied with nausea, vomiting, tympanitic abdomen, headache, and powerful pulsations of the abdominal aorta. In some cases it may be advantageously combined with asclepias. As a hydragogue cathartic, and also as a diuretic in those instances where this effect is displayed, it has been found most useful in *dropsy*. Indeed it has proved very efficient in dropsy and its accompanying symptoms, when associated with general debility or a strong tendency to struma, albuminuria being absent, removing the effusion without necessarily inducing watery stools. It is, however, seldom employed in dropsical complaints for its purgative action, but rather in the small dose for its action in removing œdematous infiltration, probably acting upon the heart by strengthening that organ, and thereby affecting the kidneys, secondarily inducing diuresis. Used for this purpose, it is the most certain diuretic in the materia medica. Certain conditions, however, govern its use. If dropsy be dependent upon structural lesions, as organic disease of the heart, liver, or kidneys, apocynum will not relieve the trouble, though it becomes a useful addition to digitalis, strophanthus, cactus, and other remedies used to mitigate the urgent symptoms. Neither would it act well where the pulse is quick and hard, evidencing circulatory obstruction, and in febrile disorders. The cases calling for apocynum are those of debility or weakness, that atonic state which readily permits exudation from the bloodvessels. Under such circumstances it is positive whether it be simple *œdema* or *anasarca*, *ascites*, or dropsy of any of the serous cavities. The indication is *watery fullness* of tissues, as if infiltrated. It may be puffiness of the eyelids, feet, or other parts; the parts pit upon pressure; and there may be a blanched, glistening appearance of the skin. Chronic cases, as a rule, are those in which it acts best, though it is of great value in *acute hydrocephalus*, as well as the chronic form, the fontanelles protruding, the sutures spreading, the eyes prominent, and the lids puffy. The dropsies following *ague* and *scarlatina* are particularly cases for its employment. In gynaecological practice it is of value in *amenorrhœa*, *passive menorrhagia* and *leucorrhœa* with watery discharges, the uterus being in all these disorders full and relaxed. Usually there is œdema of some other part. In menorrhagia the profuse flow lasts too long and too frequently recurs. It is a good remedy for the depression attending old cases of *scrofula* and *syphilis*, and in *atonic dyspepsia* fulfils an important use in removing constipation and fluid accumulations when present. *Rheumatism* yields to it when œdema of a part of or whole of the body is present, or even where there is slight puffiness or glistening of the parts. Frequently it must be given with other antirheumatics.

Apocynum is a decided heart tonic. The conditions above-named, and a dilated condition of the cardiac ventricles, point to its use. It is not the remedy where the circulation is excited, with hard, quick pulse. Dr. E. R. Freeman reports an inveterate case of *angina pectoris* benefited by it. Œdema was a feature of the case. Dr. Waterhouse (*Ec. Med. Gleaner*, 1891) relieved the *præcordial oppression* of a smoker with it. Dr. J. C. Kilgour (*Ec. Med. Jour.*, 1886) declares it a decided antineuralgic, relieving *sciatic*, *crural*, and *lumbar neuralgias*. Prof. G. C. Gere (*Cal. Med. Jour.*) asserts that it is the most valuable of deobstruents to relieve *renal congestion* in the second stage of *tubular nephritis* (*Dynam. Therap.*). Too much, however, must not be expected of it where there are structural changes of the vital organs. *Acute inflammation of the upper laryngeal* and *post-nasal region* is specifically met by this drug, according to Prof. Webster being nearly as positive as phytolacca, and preferable when the irritation does not extend beyond those parts, and is readily brought on by slight exposure (*Dynam. Therap.*). Goss found it to remove *ascarides* from the rectum when given in cathartic doses. As an emetic, from 12 to 30 grains of the powdered root-bark may be given; as a hydragogue or diuretic, the decoction is the best form in which to employ it—1 ounce of the root may be boiled in a pint of water, of which half a wineglassful, or even less, may be given 3 or 4 times a day. Smaller quantities of the decoction, given warm, will cause diaphoresis; as a purgative, the aqueous extract may be given in doses of from 3 to 6 grains. For its specific uses the decoction in small doses (a teaspoonful every 1 or 2 hours) or the specific medicine is preferred. R Specific apocynum, gtt. x to ʒj; aqua, fl℥iv. Mix. Sig. A teaspoonful every 1 to 3 hours. The decoction is most effectual.

Apocynin is reputed a powerful heart tonic, similar in action to strophanthus and digitalis.

Specific Indications and Uses.—*Watery fullness* of cellular tissues—œdema; puffiness of eyelids, and wrinkled lids as if the parts had recently been swollen; feet full and œdematous, pitting upon pressure; constipation, with œdema; scanty urine; skin glistening; circulation sluggish; passive hemorrhages, small in amount, with great depression, and œdema of the feet; hemoptysis; menorrhagia, profuse, too often and too long continued; full, relaxed uterus, with watery discharges.

APOCYNUM ANDROSÆMIFOLIUM.—DOG'S BANE.

The root of *Apocynum androsæmifolium*, Linné, gathered in autumn after the leaves and fruit have matured.

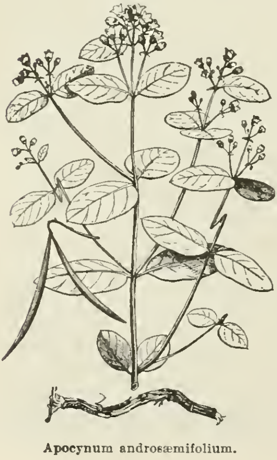
Nat. Ord.—Apocynaceæ.

Common Names: *Dog's bane*, *Indian hemp*, *Bitter root.*

Illustrations.—*Bot. Mag.*, 280; Rigel's *Med.*, 36; *Amer. Disp.*, 8th ed., Pl. 3.

Botanical Source, History, and Description.—*Apocynum androsæmifolium* has a close resemblance to *A. cannabinum*, but is found in more northern latitudes, being the more common species in Canada and in the Northeastern States. The leaves are oval, roundish, about three-fourths as wide as they are long, and end in short, mucronate points. They are smooth, of lighter color on the under surface, and are attached to the stem at nearly a right angle, on leaf-stalks about ¼ of an inch in length. The flowers are larger than in *Apocynum cannabinum*, and are disposed in loose, terminal panicled cymes, extending beyond the leaves. The corolla is flesh-colored, with spreading lobes, and more than twice the length of the calyx. Our illustration was drawn from a plant furnished by Mr. F. H. Hosford. The root of this plant is rarely found in market. It bears a general resemblance to that of *Apocynum cannabinum*, although its distinguishing characteristics are well marked, and sufficiently distinct to forbid confusion, and to prevent substitutions from being practiced upon those who have compared the two roots. *Apocynum androsæmifolium* has a long running root. When dry, it is contorted, frequently having the woody remains of its stalks attached. It is shriveled longitudinally, and often marked by transverse fractures, that extend through the bark and

Fig. 28.



Apocynum androsæmifolium.

show the white woody center. Occasionally the bark scales off. The root breaks with difficulty, its central part being woody. Externally, the bark is dark-brown, white upon its inner surface, and readily separates from the central or ligneous part of the root; it is very bitter. The central part of the root is smooth and firm, bends before breaking, and usually requires considerable twisting before the woody fibers give way. Attached to the root are rootlets, not very plentiful, which bear a general resemblance to the main root, their central portion being woody and covered by a brown epidermis. The confusion that has existed regarding the roots of *Apocynum androsæmifolium* and *Apocynum cannabinum* results from the general resemblance of the plants, and from the fact that the names *bitter root* and *Indian hemp* have been applied indiscriminately to both species by herb gatherers and country people. *A. cannabinum* is quite plentiful in localities from which our (Cincinnati) market is supplied, while the *A. androsæmifolium* is scarce. This plant, likewise called *Dog's bane*, *Milkweed*, etc., is found growing in dry, sandy soils, and in the borders of woods from Maine to Florida, flowering from May to August; when any part of it is wounded, a milky juice exudes. The large, milky root is the medicinal portion, or rather its bark, which forms the greater part of it; it possesses an unpleasant, amarous taste. It yields its properties to alcohol, but especially to water. Age impairs its virtues.

Chemical Composition.—Zollickoffer states that it contains resin, caoutchouc, and mucus. Bigelow supposed it to contain volatile oil, soluble red coloring matter, extractive, and a body resembling caoutchouc. The bitter principle has been isolated as a semi-solid mass, and is thought to contain *apocynin*, and the glucoside, *apocyneïn* (see *Apocynum*).

Action, Medical Uses, and Dosage.—Emetic, diaphoretic, tonic, and laxative. When given with capsicum or opium its emetic action is checked, and with the latter drug diaphoresis is produced. It has been found very valuable in the treatment of *chronic hepatic affections*, and in conjuction with menispermum in *dyspepsia* and *amenorrhœa*. When it is required to promptly empty the stomach, without causing much nausea, or a relaxed condition of the muscular system, the powdered root may be given in doses of 40 to 60 grains. However, it is said to occasion a subsequent weakness or languor, from which the patient is some time in recovering. As a laxative, it is useful in cases of *constipation*, and in *hepatic derangements*. As a tonic, 10 or 20 grains may be given to stimulate the digestive apparatus, and thus effect a corresponding impression on the general system. As a diaphoretic it must be combined with opium, in the proportion of 1 grain of the latter to 40 of the former, and divided into three or four doses; however, as a diaphoretic it is inferior. Also reputed useful as an alterative in *rheumatism*, *scrofula*, and *syphilis*, having been much used in the first and last complaint by the American Indians. Its chief use, however, is in *dyspepsia* with constipation, and in *headache* with torpor of the bowels, as well as in *nervous headache* and *headache* due to sluggish venous capillary circulation of the brain. It is somewhat singular that it does not meet dropsical conditions like its relative, Apocynum cannabinum. Dose: Infusion (℥j to water Oj), 1 fluid drachm to 1 fluid ounce; fluid extract, 1 to 20 drops; tincture, 1 to 30 drops every 3 hours.

APOMORPHINÆ HYDROCHLORAS (U. S. P.)—APOMORPHINE HYDROCHLORATE.

FORMULA: $C_{17}H_{17}NO_2HCl$. MOLECULAR WEIGHT: 302.79.

"The hydrochlorate of an artificial alkaloid prepared from morphine or codeine. It should be kept in small, dark amber-colored vials"—(*U. S. P.*).

SYNONYM: *Hydrochlorate of apomorphine.*

Preparation.—The salt is produced by the abstraction of a molecule of water from the morphine employed—a process of dehydration. For this purpose place into a strong glass tube pure morphine (1 part) and hydrochloric acid (20 parts). The tube should be large enough so that the mixture fills but about one-fifteenth of its capacity, and the open end securely sealed. Enclose this tube in one of metal and heat for 3 hours at a temperature between 140° and 150° C. (284° and 302° F.), preferably in an oil-bath. After cooling, water is added to the contents of the tube, and an excess of bicarbonate of sodium added. The precipitate is exhausted with chloroform or ether and the supernatant liquid poured off from the precipitate, which may be agitated with chloroform or ether to recover an additional amount of the salt. Hydrochloric acid, in very small amounts, is now cautiously added to the solution when crystals of apomorphine hydrochlorate are formed. Apomorphine should be rendered pure by recrystallizing it from boiling water, and afterward drying rapidly under a glass bell-jar over concentrated sulphuric acid, or upon layers of bibulous paper. Apomorphine may also be prepared by acting upon codeine with hydrochloric acid. This compound was first produced by Matthiessen and Wright in 1869.

Description and Tests.—The *U. S. P.* describes this salt as "minute, grayish-white, shining, acicular crystals, without odor, having a faintly bitter taste, and acquiring a greenish tint upon exposure to light and air. Soluble at 15° C. (59° F.), in about 45 parts of water, and about 45 parts of alcohol; very little soluble in ether or chloroform. When heated to near 100° C. (212° F.), the salt is decomposed, rapidly if in solution, slowly when dry. At 270° C. (518° F.) it fuses to a black mass, and, when ignited, it is consumed without leaving a residue. The salt is neutral to litmus paper. The crystals are colored blood-red to orange by nitric acid, transiently violet to light-brown by sulphuric acid, dark-purple to orange by a mixture of these acids. On shaking a few cubic centimeters of the saturated aqueous solution of the salt with a few small particles of manganese dioxide, the liquid acquires a green color, which is turned reddish-brown by adding some crystals of oxalic acid. If the oxalic acid be added to the solution first, and then a few small particles of manganese dioxide, the liquid will, upon agitation, assume a deep brownish-red color. Silver nitrate T.S. added to the aqueous solution of the salt throws down a white precipitate, insoluble in nitric acid, soon turning black by reduction to metallic silver, or instantly reduced by addition of ammonia water. Addition of sodium bicarbonate solution to the aqueous solution throws down the white, amorphous alkaloid, which soon turns green on exposure to air, and imparts a violet or blue color to chloroform, in which it is very soluble (difference from morphine). If the salt impart, at once, an emerald-green color to 100 parts of water on being shaken with it a few times in a test-tube, it should be rejected"—(*U. S. P.*).

When pure, the alkaloid, apomorphine, is an amorphous, white, or grayish-white powder, dissolving with considerable freedom in water, chloroform, ether, and benzol. After turning green by exposure to a moist atmosphere, it will dissolve with a blue tint in chloroform. With ferric chloride, an amethyst or rose-red hue is produced which serves to distinguish it from morphine, which, under like treatment, gives a blue coloration. Apomorphine salts are not readily soluble in water at ordinary temperatures, but dissolve more readily in acidulated solutions and warm water. On account of a change in properties, with the development of a green color upon exposure, solutions of apomorphine, or its salts, should only be prepared when needed for use.

Action, Medical Uses, and Dosage.—The action of this drug is exceedingly depressing, and death may result even from very small doses. The chief symptoms are pronounced sedation, giddiness, pallid surface, cold sweat, and profound collapse with unconsciousness. Usually, however, copious vomiting takes place, and the foregoing symptoms are then relieved. Sometimes, after vomiting, dangerous syncope may result. A middle-aged man, suffering from bronchitis, died in 7 minutes without vomiting, from $\frac{1}{15}$ grain hypodermatically. Deep sleep and disposition to faint sometimes follow when a disturbing dose has been administered. Owing to the fact that this agent induces a profuse, watery bronchial secretion, it is, unless in minute amounts, contraindicated in respiratory affections. However, in *catarrhal pneumonia* and *bronchitis*, minute doses ($\frac{1}{200}$ to $\frac{1}{75}$ grain) may improve a dry condition of the membranes when such a state is present. Care should be had in its use upon children. Attacks of *maniacal delirium*, *chorea*, *obstinate singultus*, *tetanus*, *rigid os uteri*, and *hystero-epilepsy* have been cut short with it administered hypodermatically. It is, however, a dangerous remedy. An emetic dose is said to very promptly relieve *hysteria*. Prof. Bloyer employs it in painful conditions of the stomach due to overloading that organ. By its prompt emetic effect in unloading the stomach, the painful attack is cut short. The chief use, however, for this salt, is as an emetic when promptness is required in relieving the stomach of *poisons*. A 1/10 or 1/8 grain dose may be hypodermatically injected and vomiting almost immediately follows. This course is to be recommended in *poisoning by strychnine*, *carbolic acid*, *opium*, and its alkaloids, etc., and in *alcoholic intoxication*. Care should be exercised in its employment in the latter state. It has been used to expel *foreign bodies* from the œsophagus. The dose as an expectorant is 1/200 to 1/75 grain; as an emetic, by mouth, 1/12 to 1/4 grain; hypodermatically, 1/25 to 1/6 grain. The smaller doses, never exceeding 1/24 grain, should be given to children. Only fresh preparations should be used.

Specific Indications and Uses.—To provoke prompt emesis in the early stage of alkaloidal and other cases of acute poisoning.

Related Salt.—Apomorphine Sulphate. This product was obtained by Arppe, in 1845, by heating together, at a temperature as high as 150° C. (302° F.), sulphate of morphine in water, and sulphuric acid in excess. It forms a practically insoluble white salt, and was named by its discoverer, *sulphomorphid*, and given the formula $C_{17}H_{18}NSO_4$. Matthiessen and Wright, who first prepared hydrochlorate of apomorphine, proved it to be apomorphine sulphate.

AQUA (U. S. P.)—WATER.

Formula: H_2O. Molecular Weight: 17.96.

Synonym: *Hydrogen monoxide*.

"Natural water in its purest attainable state"—(*U. S. P.*).

Source, Description, and History.—"A colorless, limpid liquid, without odor or taste at ordinary temperatures, and remaining odorless while being heated to boiling"—(*U. S. P.*). Water is one of our most extensive pharmaceutical agents. The purest water obtainable is distilled water (see *Aqua Destillata*), which, when properly prepared in clean glass vessels, is colorless, transparent, scarcely compressible, tasteless, and odorless, with the assumed specific gravity 1, being the standard to which the specific gravities of liquids and solids are referred. It is the only admissible water for pharmacal and chemical tests, as the presence of organic or saline substances in it, may decompose the articles to be dissolved, or impair its solvent power. At a temperature of 0° C (32° F.), or lower, it is converted into ice; boils at 100° C. (212° F.), and is converted into steam. Its crystallization into ice is accompanied with expansion, and the specific gravity of ice is 0.916; the volume of steam is about 1700 times more than that of water, and its specific gravity is 0.622. Water is perfectly neutral, exhibiting neither acid nor basic properties, though capable of combining with acid or basic anhydrides, thus developing acids and bases formerly and still incorrectly called hydrates. It likewise readily combines with many gaseous bodies, giving to them a fluid form. As a general rule, its solvent powers are increased by heat, especially in regard to solid bodies. It should always be kept in well-closed, green glass vessels. Pure water is formed by the combination of 2 volumes of hydrogen with 1 volume of oxygen, thus: $H_2+O=H_2O$ or *hydrogen monoxide*. Water is never found naturally pure, differing in many respects according to its locality. It is generally distinguished as *Soft water*, *Hard water*, and *Mineral* or *Medicinal water*. For most ordinary purposes *soft waters* are preferred to the hard, and may be distinguished by the readiness with which they dissolve soap, notwithstanding they may contain considerable foreign matters. *Hard waters*, on the contrary, holding in solution salts of calcium or other earths, dissolve soap, but subsequently form insoluble compounds with the latter; these waters are unfit for internal use or household or pharmacal purposes. In this respect water is spoken of as having *temporary* and *permanent* hardness. The former takes into account the total amount of calcium and magnesium salts, including those that are precipitated by merely boiling the water (see *Tests*). Permanent hardness refers to those salts alone that remain in solution after boiling the water. The principle involved in the determination of the hardness of a water (by Clarke's process), is simply that the calcium and magnesium salts are precipitated from the water by means of an alcoholic potassium-soap solution, of known strength, previously standardized by means of a calcium chloride solution of definite strength. When all alkaline earths are thus precipitated from the water, a slight excess of the soap solution, upon shaking the water, will cause a heavy froth which remains permanent for at least 5 minutes. The old English degree of hardness was defined as the number of grains of calcium carbonate in 1 gallon of water; by more modern usage, 1 part of calcium oxide (CaO) (German usage) or calcium carbonate ($CaCO_3$) (French usage), in 100,000 parts of water, is called 1 degree of hardness. Water is distinguished by its origin as follows:

RAIN WATER (*Aqua pluvialis*) and SNOW WATER (*Aqua nivalis*), when collected so as to prevent accidental impurities, are the purest waters to be had naturally. They are generally impregnated with the soluble matters in the atmosphere, which vary in different localities, the most common impurities being carbonic acid gas, carbonate of ammonium, chloride of sodium, organic and suspended mineral substances; during a thunder-storm traces of nitric acid and nitrates are said to be likewise present. In collecting rain water, the first that falls should be rejected; if from the tops of houses, 2 or 3 hours of continuous shower will wash off any objectionable impurities, and the water will run clear and transparent; if from an open space at a distance from dwellings, it may be permitted to fall an hour or so before attempting to collect it. To obtain it as pure as possible, it should be filtered, boiled, and again filtered. No pure water should ever be used that comes in contact with new lead—for the lead becomes oxidized by the oxygen of the water, which oxide is converted into a carbonate by the action of the carbonic acid gas derived from the air, and the water thus containing lead may produce the poisonous effects of the metal upon the system. Hard water attacks lead less readily than soft water.

Snow water is said to be richer in oxygen than other water, and is generally free from the atmospheric gaseous impurities found in rain water; it quenches thirst, while snow, not melted, augments it. The opinion at one time entertained that the use of snow water disposed to goitre is undoubtedly an erroneous one, as the disease not only occurs where snow is never seen, but is unknown in many sections of mountainous countries where the water employed is chiefly that supplied by the melting of the snow which covers the mountains. Rain and snow waters, collected with a degree of care, are applicable to every domestic purpose, as well as to many chemical and pharmacal processes.

SPRING WATER (*Aqua fontana*) is that which springs from the earth, free from large amounts of carbonic acid, or salts, and not possessing elevated temperatures; it is the general beverage of mankind, and is applicable to all domestic purposes. Its quality varies according to the nature of the soil in its vicinity; those springs arising from trap rocks, sandstones, transition, and primitive rocks, are purest; those from alluvial strata, limestone, and coal formations, are the least pure. All, however, contain variable traces of the salts of calcium, sodium, or magnesium, according to the character of the soil through which they flow.

WELL WATER (*Aqua puteana*) very much resembles spring water in its qualities, its purity being somewhat governed by the depth at which it is procured, and its daily flow. The Artesian wells usually supply a very pure water. Nitrates and organic impurities have been found in the well water of cities, as might naturally be expected from the impurities of their soils.

RIVER WATER (*Aqua fluvialis*), especially when passing through alluvial countries, and near great cities, contains suspended in it more or less earthy and organic impurities of a vegeto-animal origin, which lessen its clearness, but in a short time it becomes purified of these by deposition during its downward course. In countries where the rivers pass chiefly over primitive rocks, the waters are found to be almost perfectly pure. When moderately pure, it is fit for all ordinary purposes, though if it contains much organic matters, it is apt to occasion dysentery, and other affections of the bowels, and then becomes inadmissible in medicine.

MARSH WATER (*Aqua ex palude*), on account of its stagnation and repletion with putrescent matters, is altogether unfit for domestic or therapeutical use. This water contains among other impurities animalcules, and microscopic vegetation; although these are met with in running and clear waters in which there is considerable vegetable growth. But they are absent in spring and well waters, and most of the river waters supplied for domestic purposes. There is no doubt but that the drinking of water containing shreds or filaments of cryptogamous plants, has occasioned sickness and even death. River and lake water (*Aqua ex lacu*) should always be filtered or boiled before using as a beverage.

AQUÆ MINERALES.—(For *Mineral Waters* see *Aquæ Minerales*).

Impurities in Common Water, and Their Detection.—From 1 to 3 parts in 10,000, or even slightly more of solid matter (*U. S. P.* permits the limit of 5), if it be composed principally of sodium chloride and calcium carbonate, is permissible in good, wholesome drinking water. It may also contain carbon dioxide in the proportion of 1 volume in 100 volumes of water. The most objectionable impurities are ammonia and organic matter, the presence of which indicate contamination of the water with decaying animal and vegetable tissues. The pharmacopœial tests for *organic matter* and limit of ammonia are subsequently mentioned. Water contaminated with sewage or other nitrogenous impurities, contains ammonia, 0.10 Gm. of which in 1,000,000 renders it unfit for drinking purposes. An outline of the quantitative analysis of water, on which subject there are several well-known special works extant (*e. g.*, Wanklyn, Frankland, Miller, etc.), can not be herein considered. The *U. S. P.* gives the following criteria for the purity of water:

"A colorless, limpid liquid, without odor or taste at ordinary temperatures, and remaining odorless while being heated to boiling. Water should be perfectly neutral to litmus paper, and its transparency should not be affected, nor should any color be imparted to it, by hydrogen sulphide T.S., or ammonium sulphide T.S. (absence of metallic impurities). It should also remain unaffected by mercuric chloride T.S. (limit of ammonia). On evaporating 1000 Cc. of water on a water-bath, it should not leave a residue weighing more than 0.5 Gm. (limit of soluble salts), and this residue, when ignited, should not carbonize, nor evolve ammoniacal or acid vapors. If 200 Cc. of water be acidulated with hydrochloric acid and heated to boiling, and 0.5 Cc. of barium chloride T.S. added, the liquid, cooled and filtered, should give no further precipitate on the addition of a few drops of barium chloride T.S., even on standing (limit of sulphates). If 200 Cc. of water be acidulated with nitric acid, and 0.5 Cc. of decinormal silver nitrate V.S. be added, the filtered liquid should not be affected by the subsequent addition of a few drops of silver nitrate T.S. (limit of chlorides). If 5 Cc. of water mixed with a few drops of diphenylamine T.S. be carefully poured upon about 2 Cc. of sulphuric acid, free from nitrose, contained in a test-tube, so as to form a separate layer, no blue color should be formed at the line of contact of the two liquids (limit of nitrates). If 100 Cc. of water be acidulated with diluted sulphuric acid free from nitrose, and a few drops of zinc-iodide-starch T.S. subsequently added, the liquid should not at once assume a blue or violet color (absence of nitrites). On heating 100 Cc. of water, acidulated with 10 Cc. of diluted sulphuric acid, to boiling, and subsequently adding 0.5 Cc. of decinormal potassium permanganate V.S., the color of the liquid should not be completely destroyed by boiling it for 10 minutes (limit of organic and other oxidizable matters"—(*U. S. P.*).

Calcium salts in solution are recognized by being precipitated with ammonium oxalate T.S. Free carbonic acid gas in the water may be recognized by the addition of an excess of lime water, whereby insoluble calcium carbonate falls. If lime water is cautiously added in an amount sufficient to combine with only half, or less, of the carbonic acid gas present, the remainder of this gas will keep the calcium carbonate in solution, forming bicarbonate of calcium. This, upon boiling, is decomposed into carbonic acid gas and insoluble calcium carbonate. On this principle calcium carbonate is dissolved by natural water with the aid of carbonic acid gas, and deposited from this solution when its solvent, carbonic acid gas, is expelled by spontaneous evaporation. Organic matter may be recognized, beside the test previously indicated, by evaporating to dryness and igniting, whereby charring takes place to a greater or less degree. Organic matter also will reduce gold from a few drops of chloride of gold solution that have been added to about 1 or 2 ounces of the water to be examined. The reduction of the gold is manifested by a violet or blue coloration of the originally slightly yellow liquid. The presence of ammonia in water, beside the test indicated above, is also detected by Nessler's reagent (see *List of Reagents*). For the detection of nitrites in water there are several delicate tests. The following test, originally devised by Griess, will detect 1 part of N_2O_3 in a thousand million parts of water. It is carried out as follows: Add to the liquid to be tested some pure sulphuric acid, then a few drops of a solution of sulphanilic acid ($C_6H_4NH_2SO_3H$) and about 10 minutes afterward a few drops of naphthylamin sulphate ($C_{10}H_7NH_2.H_2SO_4$). If a nitrite is present, an intense red coloration is developed after a short while, due to the formation of an azo-dye (see *Aniline*).

Action, Medical History, and Uses.—Lack of space permits of but a brief resumé of the physiological and therapeutical actions of water; for further elucidation the reader is referred to special works on HYDROTHERAPY. The treatment of disease by means of water is by no means modern, as there is ample evidence of its employment by Hippocrates, and later by Galen, Avicenna, and Celsus. In more modern times its importance in therapy was recognized by Sir John Floyer and Dr. Baynard (England) who employed baths in chronic affections, and particularly by Dr. James Currie, of Liverpool (1797), who published a work upon the uses of cold and warm water in fevers and other diseases. His views, given to the world at a time when even a drink of cold water was rigidly denied the fever patient, naturally met with violent opposition from a large portion of the medical fraternity, though his sensible doctrines and practices met with considerable favor in some quarters. Though affusions were largely recommended by him, an important feature of his practice consisted in the administration of cold drinks in fevers. Later, however, a renewed impetus was given the water treatment through the discoveries of Vincenz Priessnitz, the peasant-farmer of Silesia. Having sprained his wrist, Priessnitz resorted to affusions of cold water, followed by the *Umschlag* (wet bandage). Priessnitz was but 13 years of age, but so successful was his treatment that in subsequent injuries to himself he resorted to similar treatment. As in each instance, an eruption was produced by the constant wet application, he conceived a theory that it was indicative of impure blood, and this subsequently led him to adopt a "humoral" pathology, and to declare that all morbific matters (acrid humors) were eliminated by "crisis" (the eruption). His treatment was extended to the ulcers, injuries, etc., of his neighbors, and finally, in 1826, he opened an establishment for the treatment of disease by means of water, and his fame became world-wide. Though lacking in scientific knowledge, and entertaining many mistaken hygienic views, yet his treatment, coupled with improved habits of living and eating, and plenty of fresh air and exercise, proved eminently successful. In 1844 the treatment was introduced into New York City. While undoubtedly much credit is due Currie as the originator of hydropathy as now practiced, its establishment as a therapeutic measure is due to the persistency and the success of the unlettered Priessnitz in pursuing his novel methods of treatment. The treatment, as pursued by Priessnitz and his followers, is that commonly known as *Hydropathy;* as now employed it is known as *Hydrotherapy*. Owing to the unscientific and injudicious methods of the followers of Preissnitz, his methods gradually fell into disrepute, and in medical circles but little more was heard of it until Brand, of Stettin (1861), gave his scientific reports of the use of cold baths in typhoid fever; since which time the treatment of fevers by means of baths has been by modifications of Brand's method.

In recent years much importance has been attached by some physicians to the cold bath in *fevers*, particularly those of a typhoid type. According to its advocates, it is contraindicated, chiefly by intestinal hemorrhages, which it appears to favor, and by peritonitis. Brand's method is to immerse the patient, wrapped in a sheet and his head first wetted, into a large bath of water at 15.5° to 21.1° C. (60° to 70° F.), whenever the patient's temperature reaches 39° C. (102.5° F.). The body is briskly rubbed through the sheet, and stimulation resorted to if shock and cyanosis seem to demand it. After remaining in the bath for 15 or 20 minutes, the patient is removed from the bath, the wet sheet quickly replaced by a dry one, and the patient placed in bed, covered with a light blanket. The rectal temperature is taken immediately after immersion and again in 45 minutes. When the temperature again reaches 102.5° F. or over, the bath is repeated, and so on indefinitely. Ziemssen's method consists in employing the bath at about 36.6° C. (98° F.), and cooling the water during the immersion, by means of ice, to 26.6° C. (80° F.), 15.5° C. (60° F.), or even 4.4° C.

(40° F.), according to effect upon temperature. After the bath, the patient is dried, placed in bed, and covered with blankets. The temperature is taken per rectum. Ziemssen, Immerman, and others, administered the baths at regular intervals; others have modified Ziemssen's method by employing the bath only as the rise of temperature seemed to demand it. Still others, as Osler, have recommended and practiced baths at 29.4° to 32.2° C. (85° to 90° F.) and cooling to 21.1° C. (70° F.). The claims made for the cold bath, and particularly by Brand's method, are: Reduction of temperature, control of muscular twitchings, brightening of the intellect, soothing of the nervous system, the induction of sleep, increased heart-power, improvement of the skin, and low mortality. Ziemssen's method is said to give less shock, and Osler's method is asserted to be less effective in reducing temperature (see also paper by G. S. Harrington, M. D., in *N. Y. Med. Times*, Aug., 1897, p. 239).

The use of the bath as above described, has not found favor in the Eclectic school. The medical treatment of fevers, as pursued so successfully by our physicians, and with results that have gained fame for the methods of our practice, has been such as to beget an unwillingness to abandon successful and pleasant methods for a procedure at best uncertain, and extremely uncomfortable and annoying to the patient. Briefly, the following resumé will indicate some of the uses of hot and cold water, both internally and externally.

As a remedial agent, apart from its natural necessitous use, water internally is a tonic, diuretic, or sudorific, according to its mode of administration. Small quantities, taken cold, between 7.2° to 15.5° C. (45° to 60° F.), and occasionally repeated, act as a tonic; in larger doses it produces diuresis and diaphoresis, the latter effect more especially, if the patient be kept warmly covered; and it is extensively used for this purpose in many acute diseases. Warm water, of a temperature varying from 18.3° to 37.7° C. (65° to 100° F.), and especially when taken in large quantities, will usually produce sickness and vomiting, and its continued daily use in small quantities will impair the tone of the stomach. Cold water, from 1.1° to 7.2° C. (30° to 45° F.) is a grateful drink, more particularly to *fever* patients, allaying thirst, moderating the fever, often producing sleep and relief from restlessness, and is sufficient, unaided by other means, to effect a rapid solution of the disease, in many instances. It should never be withheld from patients laboring under *febrile* or *inflammatory complaints*, who crave it. During the operation of a vegetable emetic, cool water at 15.5° C. (60° F.), is more agreeable, and fully as beneficial in assisting emesis, as warm. Cold drinks are very useful in *chronic constipation*, a glass of cold water being drunk before breakfast. With some, warm water acts best as a laxative. Owing to its diuretic effect, an abundance of water assists in washing out the kidneys in *acute desquamative nephritis*. Water, in judicious amounts, may be administered in *acute gastric inflammations*. Ice held in the mouth frequently aids in subduing *tonsillitis*. The ingestion of warm water is frequently useful in *gastralgia*, *dyspepsia*, *chronic diarrhœa*, *gout*, *rheumatism*, and in many *chronic skin affections*.

The effects of water employed externally, depend upon its temperature. The *cold bath* acts according to its degree of cold, the manner in which it is used, and the peculiar state of the body at the time. When below 10° C. (50° F.), the bath is considered very cold. The primary effects of a cold bath constitute the *shock*—its secondary effects, the *glow*, or reaction. The immediate effects of a cold bath are a sensation of cold, which gradually ceases, and is succeeded by numbness, the skin becomes pale, and covered with *cutis anserina*, there is shivering, with quick and irregular respiration, and a contraction of the cutaneous vessels, as well as of the volume of the body. If the immersion be continued, the pulse becomes slow and small, drowsiness and cramps come on, the heat of the body diminishes rapidly, and finally syncope and death occur. A cold bath is usually taken for its stimulating and tonic influence, and hence, should not be below 10° C. (50° F.), nor above 23.8° C. (75° F.), and the immersion should be temporary. Reaction speedily follows, capillary circulation is re-established, a glow is felt, perspiration comes on, the pulse becomes full and frequent, and the whole system feels invigorated. Delicate or weakly persons should not take a cold bath. It is a common opinion that immersion in cold water is dangerous when the body is heated by exercise or other exertion; and hence it is customary with bathers to wait until they become cool. The first is an erroneous opinion; the second an injurious act. Cold water abstracts heat from the body, first becoming sedative, and then, if immersion be not too prolonged, it acts secondarily as a stimulant. Under the cold bath, properly employed, the body gains in weight.

Warm water, according to its temperature, affects the system in varying degrees, but the quality of the action is similar, no matter whether the bath be warm or hot. A sense of warmth is first experienced, followed by increased vascular activity of the skin, the latter becoming red. Respiration is quickened, and the heart action increased, though the vessels lose tension. The body takes on heat, the radiation of which is prevented, and the temperature amounting in some persons, if the bath be hot, almost to a fever. The renal secretions are diminished, while those of the skin and lungs are augmented, through which the body loses weight. Unpleasant præcordial oppression, and a feeling of fullness in the head, with a sense of distension, dizziness, and faintness, are among its effects. If too prolonged, or too high in temperature, the hot bath may produce bleeding at the nose and lungs, cerebral congestion, or apoplexy. They are contra-indicated where the cerebral vessels are known to be diseased. The hot bath is somewhat similar in its effects to the vapor, but is apt to prove dangerous in some constitutions. Dr. J. Chapman states that heat along the spine lessens the general circulation, overcomes congestion in all parts of the body, lessens fever, checks hemorrhage, and diminishes or suspends the menses.

Externally, water is frequently applied as a sedative in local inflammations, as *quinsies*, *sore throats*, *ophthalmia*, *sprains* and *contusions*, and as a means of restraining *hemorrhage*. Cloths wet with cold water and applied to the abdomen, have relieved severe *pain in the bowels*, *retention of urine*, etc. The cold dash or douche, has been successfully employed in *delirium tremens*, *apoplexy*, *tetanus*, *hysteria*, *convulsions*, *obstinate constipation*, *congestive*, *bilious*, and *typhoid fevers*. The wet sheet is much used to allay *febrile* and *inflammatory conditions*, and to promote diaphoresis. As an injection, it has been efficient in *habitual constipation*, and excessive tympanitic distension, as well as in *dysentery*. Applied warm it is an excellent application to *erysipelatous inflammations*. Ice and iced water, as local applications, are said to be very useful in *burns* and *scalds*; also in many *cerebral affections*. Prof. C. E. Brown-Sequard considered the application of cold to the spinal column to produce a contraction of blood-vessels by a reflex action, but if this action be very powerful, it will be followed by exhaustion and dilatation of the blood-vessels, and an actual increase of the amount of blood circulated in the cord. Dr. J. Chapman considered that ice applied upon the spinal column augments the general circulation, checks the *cramp* of voluntary and involuntary muscles, restrains the *sickness of pregnancy*, cures *sea-sickness*, and promotes menstruation. He stated to have used it successfully in *epilepsy* and other *convulsive affections*, in *paralysis*, *tetanus*, and in *cerebro-spinal fever*. His views have been published and are worthy of consideration. Locally, both cold and warm water are very useful in *surgical procedures*, particularly in *sprains*, *bruises*, *contusions*, etc., and the local warm bath is particularly valued in *lacerated wounds* and *contusions*. The application of cold water, snow or ice to *frost-bites* is well known.

The following are the temperatures at which baths are usually applied:

Water, cold	10° to 23.8° C.	(50° to 75° F.).
" temperate	23.8 to 29.4 C.	(75 to 85 F.).
" tepid	29.4 to 33.3 C.	(85 to 92 F.).
" warm	33.3 to 36.6 C.	(92 to 98 F.).
" hot	36.6 to. 44.4 C.	(98 to 112 F.).
Vapor if breathed, tepid	32.2 to 37.7 C.	(90 to 100 F.).
" " warm	37.7 to 43.3 C.	(100 to 110 F.).
" " hot	43.3 to 54.4 C.	(110 to 130 F.).
" if not breathed, tepid	35.5 to 41.1 C.	(96 to 106 F.).
" " warm	41.1 to 48.8 C.	(106 to 120 F.).
" " hot	48.8 to 71.1 C.	(120 to 160 F.).
Hot air, as a sudorific	29.4 to 37.7 C.	(85 to 100 F.).
" " as a stimulant	37.7 to 54.4 C.	(100 to 130 F.).

The VAPOR-BATH increases the action of the capillary vessels, causing excessive diaphoresis; it renders the skin pliable, relieves tension and rigidity of the joints, and may be usefully employed in *rheumatism*, *cutaneous affections*, *gout*, *profuse sweating* from cutaneous debility, tardy or imperfect eruptions of the *exanthemata*, *paralysis*, *dropsy*, etc. It is of particular value in *nephritis*, and, directed into the mouth, in *membranous croup*. The Russian bath is a form of vapor bath in which the patient is subjected to the vapor of water at 35° to 43.3° C. (95° to 110° F.). It should not be borne longer than a quarter of an hour, and the bath should be followed by a cold bath or the dashing of cold water over the body, associated with friction.

The vapor bath may be conveniently given, and in a very simple manner, by placing the patient between blankets, on a bed previously protected by a rubber sheet, and tucking the covering well around the head and shoulders, and down at the sides of the bed. Then, by means of rubber tubing, conduct the steam from a partially filled tea-kettle of boiling water, kept hot by placing the kettle upon an oil or other heating apparatus, into the space between the blankets. Care should be had that the jet of steam does not come in direct contact with the flesh. If the patient is able to sit up, a low stool may be utilized, and the patient covered with a blanket under which the jet of steam may be directed. Fresh lime is sometimes resorted to to raise a vapor, and is particularly of value in *diphtheria* and *croup*. The *spirit vapor bath* is referred to elsewhere.

The TEPID-BATH (29.4° to 33.3° C. [85° to 92° F.]) is useful in softening and removing the broken-down epithelium, as well as the sebaceous and sudoriferous secretions. It does not appreciably reduce temperature, and no reaction follows.

The WARM-BATH (33.3° to 36.6° C. [92° to 98° F.]) relaxes the system, lessens the activity of the circulatory and respiratory organs, ultimately somewhat diminishes the temperature of the body, and tends to tranquilize and occasion somnolency. It is useful in *spasms* and *convulsions of children*, *retention of urine*, *nephritic pains*, etc., and occasionally through its secondary effects in *high inflammatory* and *febrile diseases*, it will frequently prove advantageous. It should not be used in cerebral and pulmonary affections.

The TEPID or WARM SPONGE-BATH is exceedingly useful in many *febrile conditions*, for when employed in this manner, the skin is well relaxed, and the radiation of heat is not prevented as by immersion. There can be no doubt but that sponging the head *constantly* with warm water, drawing the sponge back and forth, and at the same time fanning the parts, is far more effective and safe in cases of *insolation*, *cerebro-spinal inflammations*, etc., than is the local application of cold water or ice, which probably does little more than chill the surface.

The COLD SPONGE-BATH (12.7° to 26.6° C. [55° to 80° F.]) is frequently employed by some to reduce temperature and allay nervous excitement; the anterior surface of the body being first sponged, and then the dorsum. Dr. G. S. Harrington (*N. Y. Med. Times*, 1897) advises the addition of 20 to 35 per cent of alcohol to increase the antipyretic value of the bath. The patient is then to be covered with a light sheet and blanket.

Cold water may also be used by affusion, shower-bath, or douche, and will be found tonic, stimulant, or sedative, according to its temperature, the length of time it is used, and the state of the body.

In addition to the above uses of water, it has likewise other employments, as follows:

The WET-SHEET PACKING, or *Lein Tuch* of the Germans. A mattress of cotton, hair, or straw, has spread over it three or four large, thick comfortables, and over these one or two soft flannels. A linen sheet, having been previously dipped in cold water, or for very delicate persons in tepid or even warm water, is lightly wrung out, so as not to drip, and spread over the whole, having under it one or two pillows for the head. The patient is made to lie upon these on his back, and is quickly and snugly enveloped in the wet sheet, over which is placed the flannels and blankets, or a light feather bed may be thrown over the top, in case comfortables are not plenty. Care should always be taken to turn the clothing snugly and smoothly around the feet and neck; and if the feet remain cold, bottles of hot water should be placed to them. Headache is prevented or removed by the application of cold wet cloths applied to the head.

The time for remaining thus "packed" varies in different cases, averaging from half an hour to an hour, depending on the effect; the body should become comfortably warm before being removed. A disagreeable sensation of cold is first experienced, which is soon followed by a pleasurable warmth over the whole surface, and sometimes copious perspiration, though this last is not always indicated. On coming out of the "pack," the plunge, the douche, rubbing wet sheet, or towel washing, are to be employed, as the case may require. If the patient experiences a chill after coming out, a thorough rubbing, followed by 15 or 20 minutes' dry packing, will usually obviate all injurious consequences. The process of packing should never be continued so long as to cause headache, languor, muscular debility or giddiness.

This is said to act as a sedative, reducing the heat of the body, and excessive arterial action, and as an alterative, correcting morbid secretions, and restoring healthy ones. In *fevers* and all *acute inflammatory disorders*, it may frequently be renewed according to the degree of fever or inflammation, until the temperature and circulation are reduced to the natural standard, and the skin becomes soft and perspirable. Much sweating is not usually to be desired. In *chronic diseases*, it removes internal congestions, develops external circulation, produces a healthy condition of the skin, and may be used in many forms of this class of maladies. If carelessly attended to the wet sheet may give rise to serious difficulties.

When the wet sheet is applied to the trunk of the body only, as in cases of feeble persons, where there is not sufficient vitality for the whole sheet, or for other purposes, it is termed the "HALF-PACK" SHEET.

The RUBBING WET-SHEET is a large sheet dipped in water, and wrung out so as not to drip. It is then suddenly thrown around the patient's body, enveloping him closely from the neck to the feet, and the body is then rubbed for about 5 minutes by the hands of the attendants on the outside of the sheet. It is to be followed by rubbing with dry towels. This produces a strong and general determination to the whole surface, and is applicable in all cases where a strong determination is desired from internal organs or surfaces to the skin. It will be found valuable in the early stages of *bowel complaints, diarrhœa, dysentery, colic, fevers*, etc.; it is likewise useful for *exhaustion* following mental exertion, many forms of *insanity, delirium tremens, night-sweats, wakefulness, nightmare*, etc. When the sheet is employed drippingly wet (*the dripping sheet*), a large tub or pan is necessary for the patient to stand in, to avoid wetting the floor.

The DOUCHE is the application of a stream of cold, tepid, or warm water, from a greater or lesser height, and continued for a time indicated by its effects. The force of the stream and time of application should be carefully adapted to the strength of the patient. Very nervous persons, and those subject to determinations to the brain, should resort to it with extreme caution. A strong douche should never be applied to the head, nor should it be long continued on any one spot along the vertebral column. A douche may be vertical, oblique, horizontal, or ascending. The most common are in perpendicular streams 1 or 2 inches in diameter. Its effect is to arouse the activity of the absorbent system, and is hence very useful in *gout, rheumatism, paralysis, chronic enlargements of the viscera, tumors*, etc. The ascending douche will be found beneficial in *piles, uterine displacements, prolapsus ani, constipation* from debility, *chronic enlargement of the prostate gland, impotency*, etc. The stream may be ½ to 1 inch, and should not be forcible enough to cause absolute pain nor serious inconvenience. Warm-water douches are for the purposes of producing relaxation of the muscles of the part acted upon, and are hence useful in *rigidity of the muscles, painful swellings, chronic inflammation of the joints, neuralgia, spasmodic* and *bilious colic, retention of urine, amenorrhœa, uterine rigidity, leucorrhœa, metritis, renal colic*, etc. In some cases it should be followed by a momentary cold dash. Prof. Brown-Sequard considered the *Cold douche* or *Cold shower bath*, useful in *white softening* and *reflex paraplegia*; and the *Hot douche* (37.7° C.) [100° F.], when applied to the spinal column over the painful part, very efficient in *congestion* or *inflammation of the cord*, but injurious in white softening and reflex paraplegia.

The HIP OR SITZ-BATH is a common tub, in which the patient sits so as to have the water cover the hips and lower parts of the abdomen. A vessel made for the purpose, with a back to rest against, is more convenient. The water may be of any temperature, and the time of application varies from 5 to 30 minutes.

According to its application it is tonic, derivative, or sedative. Tonic when applied from 5 to 15 minutes; derivative when extended from 15 to 30 minutes; and sedative according to its effects. Derivative hip baths should not be carried to the point of producing paleness or lividy of the lips, shiverings, nausea, faintness, or headache, and according to the effect desired, and the coldness, torpor, and debility of the patient, indicate that the quantity of water should be lessened, or its temperature elevated. It is useful in *debility, irregularity, obstruction*, and *torpor* of the organs of the pelvis and lower part of the abdomen. A blanket is generally thrown around the patient during this bath.

The SHALLOW-BATH is a circular, or oval tub, raised about 12 inches from the floor, and with water in it from 4 to 6 inches deep. The patient sits in this, while the attendant sprinkles his head, and rubs his chest, abdomen, and back. It may be employed from 1 to 30 minutes, and should be followed by a good, dry rubbing. It is used at a temperature from 15.5° to 23.8° C. (60° to 75° F.), and is excellent in *cutaneous affections*, and other cases where a mild derivative, or moderately sedative influence is desired.

The PLUNGE-BATH may be any vessel or place, the water being from 12.7° to 18.3° C. (55° to 65° F.), which will allow the patient to plunge into it, head or feet foremost as he fancies, or to quickly immerse the whole body up to the neck. The time for remaining in it varies from a few seconds to 2 or 3 minutes, or in *high fever*, to 10 or 15 minutes. It is generally taken after the sweating process, and after the wet sheet, when the patient can bear the exertion; in these cases the sheet is not to be removed until at the plunge. It is very useful in all *febrile* and *chronic affections*, but should be employed with care, or avoided altogether in consumptive and dropsical patients, and those laboring under organic diseases of the heart.

These are the principal applications of water in practice; yet there are several others of a useful character, as the *Foot-bath*, the *Head-bath*, the *Shower-bath*, etc., the modes of application of which are generally well understood, as well as their effects. Cold water may likewise be used in form of a *bandage* or *girdle*, by applying one or more folds of linen wet in cold water, to the part affected, or around the abdomen, and covering it with a dry cloth or other material to retain the heat. The *wet girdle* or *abdominal wrapper* or *compress*, is applied around the abdomen in all acute diseases of the abdominal viscera. The *bandages* are applied *warm* or *cold*, according to the indications they are intended to fulfil. The application of hot water by means of wetted cloths laid upon the parts, is very effective in painful conditions, as in *dysmenorrhœa*, various forms of *colic*, *rheumatism*, and *neuralgia*, and to *inflammatory swellings*. The *rubber water bottle* is an excellent apparatus for the application of moist heat.

AQUÆ MEDICATÆ.—MEDICATED WATERS.

These consist of water holding in solution some medicinal or aromatic principles, as certain gases, volatile oils etc. Heretofore those waters which contained a portion of the aroma of certain plants, were procured by distilling water from either the fresh or dry herb; the principal portion of the volatile oil which collected on the top of the distillate upon standing, was removed, a sufficient amount being retained by the water to render it of the taste and odor of the plant. But such distilled waters are very apt to become spoiled, unless great care be taken to redistill them from time to time, or add to them some preservative material which is frequently an undesirable addition. It has, therefore, been found the best method to triturate the essential oil itself with certain substances in the water, which so minutely divide the former as to render it more soluble in the latter, as carbonate of magnesium, pumice stone, finely powdered glass or silica, etc., which yield a clear and permanent solution after being filtered through paper. Carbonate of magnesium was, previous to 1880, the medium more commonly employed in this country. The *U. S. P.* now directs precipitated calcium phosphate. As ordinary water contains several agents which may decompose or ultimately destroy the aromatic virtues imparted to it by the above method, it is of much importance that distilled water only be always used. T. B.

Groves succeeded in recovering volatile oils from their watery solutions, by first adding to them olive oil, and then saponifying with potash. The soap thus formed, when decomposed by an acid, liberates the mixed oils, from which the aromatic portions may be separated by shaking with alcohol (*Pharm. Jour. and Trans.*, V. 347, Feb., 1864).

Medicated waters have been made by adding to a few pounds of the leaves or flowers of the article required, 6 or 7 fluid ounces of proof-spirit, and 2 gallons of water; from which 1 gallon is distilled. In this way was formerly obtained nearly all of these preparations, but the processes given below are now esteemed the best. *Aqua Aurantii Florum*, orange-flower water, *Aqua Fœniculi*, fennel water, *Aqua Menthæ Piperitæ*, peppermint water, *Aqua Menthæ Viridis*, spearmint water, together with several others, may be procured from the plants or flowers, by the mode of distillation just referred to. The *U. S. P.* of 1880, directed the preparation of several of the medicated waters prepared from oils by adding to cotton a few drops at a time of the desired oil, carefully picking the cotton apart after each addition, after which the cotton was packed firmly in a conical percolator, and upon it distilled water was poured until the percolate measured 1000 parts. By this method it was found that either not enough of the oil was taken up by the water, or else free globules of oil passed through into the percolate, thus rendering it of uncertain strength. This method has been abolished. The objection to the use of magnesium carbonate, which was formerly employed in making these waters also, is that the salt itself is slightly soluble in water, so that when a substance like silver nitrate was directed to be dissolved in such a water, a precipitate of silver carbonate was thrown down. It has been replaced by precipitated calcium phosphate.

AQUA ACIDI CARBONICI.—CARBONIC ACID WATER.

Synonyms: *Soda water, Mineral water, Artificial Seltzer water, Aqua carbonica.*

Preparation.—This is prepared by saturating water under pressure with carbonic acid gas (see *Acidum Carbonicum*), generated by the action of diluted sulphuric acid on pulverized marble by means of an apparatus manufactured for the purpose. Five or six volumes of gas may thus be condensed in 1 volume of water.

History and Description.—At the ordinary temperature and pressure of the atmosphere, 1 volume of water absorbs 1 volume of carbonic acid gas, and acquires a specific gravity of 1.0018. By doubling the pressure, the quantity of gas absorbed by the water is doubled, and so on for other degrees of pressure; for, according to Henry's law, the quantity of gas forced into the water is directly as the pressure (P.). Thus, for water to absorb 5 times its bulk of this gas, a pressure of 5 atmospheres must be used.

The "soda water" of commerce, the well-known summer beverage, is merely a carbonic acid water, rendered more palatable by the use of some aromatic or agreeable syrup; when the carbonated water and syrup are mixed and bottled, it is then known by the name of "mineral water." Water containing carbonic acid gas is very effervescent, has a pleasant, tingling, slightly acidulous taste, and an acid reaction. The vessels containing it should be strong, and perfectly airtight, and kept in a cold place, otherwise the gas will escape, and the water lose its sparkling activity. Too much care can not be taken to avoid metallic impurities, especially lead, which should not be used at all where the carbonic acid water can come in contact with it; the pipes leading from the fountain should be made either of block tin or gutta-percha. The fountain containing this water, if made of copper, should be well lined with tin, and should be carefully examined every season before using it. The glass-lined iron fountains are preferable. Ammonium sulphide or hydrogen sulphide should not be discolored by carbonic acid water.

Action and Medical Uses.—Carbonic acid water is a refreshing, refrigerant beverage, useful to allay thirst, check nausea, and promote diuresis. It may be used in *fevers, inflammatory diseases, chronic inflammation of the stomach, vomiting of pregnant females*, etc.; and may be taken 3 or 4 times daily, in doses of from 3 to 6 fluid ounces.

AQUA AMMONIÆ (U. S. P.)—AMMONIA WATER.

"An aqueous solution of Ammonia (NH_3 = 17.01) containing 10 per cent. by weight, of the gas. Ammonia water should be kept in glass-stoppered bottles, in a cool place"—(*U. S. P.*).

SYNONYMS: *Liquor ammoniæ, Solution of ammonia.*

Preparation.—"Take of ammonium chloride, 13 ounces; quicklime, 13 ounces; water, 7½ fluid ounces; distilled water, 12 fluid ounces. Slake the lime with the water, cover it up till it cools, triturate it well and quickly with the chloride of ammonium previously in fine powder, and put the mixture into a glass retort, to which is attached a receiver with a safety-tube. Connect with the receiver a bottle also provided with a safety-tube; and containing 4 ounces of the distilled water, but capable of holding twice as much. Connect this bottle with another loosely corked, and containing the remaining 8 ounces of distilled water. The communicating tubes must descend to the bottom of the bottles at the further end from the retort; and the receiver and bottles must be kept cool by snow, ice, or a running stream of cold water. Apply to the retort a gradually increasing heat till gas ceases to be evolved; remove the retort, cork up the aperture in the receiver where it is connected with the retort, and apply to the receiver a gentle and gradually increasing heat, to drive over as much of the gas in the liquid contained in it, but as little of the water as possible. Should the liquid in the last bottle not have the density of 0.960, reduce it with some of the stronger aqua ammoniæ in the first bottle, or raise it with distilled water, so as to form aqua ammoniæ of the prescribed density" (*Ed.*). The fluid measures in this formula are Imperial. We have by this process *Aqua Ammoniæ Fortior*, specific gravity 0.901 at 15° C. (59° F.), (*U. S. P.*), and *Aqua Ammoniæ*, specific gravity 0.960 at 15° C. (59° F.), (*U. S. P.*). A commercial form of ammonia water designated "F. F. F." or "20°" contains usually about 14 per cent of ammonia gas.

Description and Tests.—"A colorless, transparent liquid, having a very pungent odor, an acrid, alkaline taste, and a strongly alkaline reaction. Specific gravity 0.960 at 15° C. (59° F.). It is completely volatilized by the heat of a water-bath. On bringing a glass rod dipped into hydrochloric acid near the liquid, dense, white fumes are evolved. On slightly supersaturating 10 Cc. of ammonia water with diluted sulphuric acid, no empyreumatic odor or red color should be developed, and if to this liquid 1 Cc. of centinormal potassium permanganate V.S. be added, the pink color should not be completely destroyed within ten minutes (absence of readily oxidizable matters). If ammonia water be mixed with 4 times its volume of calcium hydrate T.S., it should not afford an immediate turbidity (only minute traces of carbonic acid); and if it be diluted with twice its volume of water, it should not be affected by ammonium oxalate T.S. (absence of calcium), nor should it be affected by hydrogen sulphide T.S., either before or after neutralization with hydrochloric acid (absence of metallic impurities). If ammonia water be slightly supersaturated with nitric acid, it should not be affected by barium chloride T.S. (absence of sulphates), nor by silver nitrate T.S. (chlorides); and if a third portion of the acidulated liquid be evaporated on a water-bath to dryness, it should afford a colorless residue, which, on ignition, should be completely volatilized (absence of coal-tar bases, and of fixed impurities). To neutralize 3.4 Gm. (3.54 Cc.) of ammonia water should require 20 Cc. of normal sulphuric acid (each cubic centimeter corresponding to 0.5 per cent of ammonia), rosolic acid being used as indicator"—(*U. S. P.*).

Occasionally a commercial form of ammonia water is prepared by adding to the ammoniacal liquor derived from gas works a quantity of milk of lime and passing the gas so obtained into water. If prepared in this manner, however, the product is apt to contain certain empyreumatic substances rendering it difficult of purification. Purification of such a product is accomplished, however, by passing the ammoniacal gas through a series of wash-bottles and lastly through charcoal contained in a series of tubes.

A delicate test for ammonia in aqueous solution is that with Nessler's reagent. The specific gravity of solution of ammonia will show the percentage of ammonia contained in the solution. Davy, in "*Elements of Chemical Philosophy*," p. 268, has given the following table for this purpose.

100 parts of specific gravity at 15° C. (59° F.) contain of ammonia:

SP. GR.	AMMONIA.	SP. GR.	AMMONIA.
0.8750	32.50	0.9435	14.53
0.8875	29.25	0.9476	13.46
0.9000	26.00	0.9513	12.40
0.9054	25.37	0.9545	11.56
0.9166	22.07	0.9573	10.82
0.9255	19.54	0.9597	10.17
0.9326	17.52	0.9619	9.60
0.9385	15.88	0.9692	9.50

Action and Toxicology.—Water of ammonia is a powerful irritant and narcotic poison, producing, in large doses, tetanus and coma, and in smaller quantity, inflammation or ulceration. Plants exposed to its vapors, shrivel and fade; animals are asphyxiated by it. Stronger ammonia applied to the cutaneous surface occasions heat and burning pain, with redness and vesication. If in large amount and long applied, a painful and even gangrenous ulcer, difficult to heal, is produced. The vapors inhaled, produce sneezing, burning of the nasal membranes and increased lachrymation, and in contact with the eye occasion burning pain and conjunctival inflammation. The inhalation of the gas, if strong and in sufficient quantity, may produce inflammation of the mouth and broncho-pulmonary tract, and occasionally causes œdema of the glottis, and death. If the person be insensible, the inhalation may cause death by asphyxiation. Internally, small doses do not sensibly affect the healthy individual, but are prompt in showing their effects in low states of the nervous system. Tension in the head, exhiliration, increase of strength, with greater activity of the cutaneous, renal, and bronchial functions, are observed. Such effects are not followed by depression. Large doses cauterize the parts over which it passes, and visceral inflammation, with local œdema, follows. Death may be produced by moderate amounts, while again excessive quantities have been followed by recovery. The antidotes to it when swallowed in large doses, or in an undiluted state, are acids, as vinegar, juice of oranges, lemons, cider, etc., which should be administered at once to secure any good effects; they combine with the ammonia, forming harmless salts; or olive oil may be given. Inflammatory symptoms must be met according to indications. In poisoning by inhalation, the best antidote is the vapor of hydrochloric acid cautiously inhaled.

Medical Uses and Dosage.—In medicinal doses, ammonia water is an energetic stimulant, especially of the nervous system, prompt, diffusible, and transient. It is adapted for speedily rousing the action of the vascular and respiratory systems, and for the prompt alleviation of *spasm*. It exerts but little action on the cerebral functions, while it stimulates the vascular system. It acts as a useful antacid in cases of *acid stomach*, and in diseases which are caused or augmented in severity by this gastric condition, as *sick headache*, *spasm*, *heart-burn*, *palpitation*, etc. It has likewise been used as a stimulant and antispasmodic in *neuralgia* of the face and head, *asthma*, *pertussis*, and *delirium tremens;* it is highly recommended as an internal stimulant in cases of *retrocession of old and obstinate cutaneous eruptions*. The vapor of water of ammonia, inhaled through the nostrils, makes a powerful impression on the nervous system, and is useful in *syncope*, *asphyxia*, and to prevent an attack of *epilepsy*, *hysteria*, etc. Ammonia water should be remembered as the antidote to *poisoning* by the inhalation of the vapors of chlorine and bromine. By intravenous injection, ammonia water has promptly antidoted the toxic effects of hydrocyanic acid, hydrochloric acid, privy gas, and alcoholic intoxication. I have used the water of ammonia successfully in the treatment of *hydrophobia*, an account of which will be found in the *Western Medical Reformer*, Vol. VI, Oct., 1846, p. 83; since which it has been used by others in this country and Europe, and with very successful results, and some have also found it a very efficient remedy against the *bites of venomous serpents* (J. King). On the other hand, several observers, Fayrer among them, uphold the views of Fontana, of Florence, enunciated in 1782, to the effect that it is useless, or at least very uncertain in its action, in such accidents. It is very probable, however, that in some cases it tends to sustain the heart, and should be cautiously used by intravenous injection. As an inhalation to check *incipient* *catarrhal disorders* of the respiratory passages, it has not found much favor in our school. It is an appropriate remedy in retrocession of the eruption in the *exanthemata*, and to sustain the vital powers in the torpor, prostration, or sinking of *typhoid* and *typhus fevers*, and other adynamic conditions. It is also of value in the cold stage of *congestive intermittents*. Externally, water of ammonia may be used as a rubefacient, irritant, or vesicant, as may be required, in *rheumatic* and *neuralgic pains*, and internal *inflammations*. It has been found to benefit *burns* and *chilblains* when superficial and not too extensive. The *stings* of bees and wasps, and the *bites* of mosquitoes, spiders, and like insects, are relieved by its local application, and it should be given internally when depressing effects follow such accidents. Its combination with oil forms a rubefacient liniment much used. Dose of water of ammonia, from 5 to 20 or 30 drops, sufficiently diluted. (See also *Aqua Ammoniæ Fortior*).

Specific Indications and Uses.—Feeble circulation, with pallor and lack of expression in the lips, eyes dull, with pupils dilated or immobile; nose, ears, and forehead cold—want of stimulus; stings and bites of insects and reptiles.

AQUA AMMONIÆ FORTIOR (U. S. P.)—STRONGER AMMONIA WATER.

Preparation.—(See *Aqua Ammoniæ*).

Description.—"An aqueous solution of ammonia (NH_3=17.01) containing 28 per cent, by weight, of the gas. Stronger ammonia water should be kept in strong, glass-stoppered bottles, not completely filled, in a cool place. A colorless, transparent liquid, having an excessively pungent odor, a very acrid and alkaline taste, and a strongly alkaline reaction. Specific gravity 0.901 at 15° C. (59° F.). If stronger ammonia water be diluted with twice its volume of water, it should respond to the reactions and tests described under ammonia water (see *Aqua Ammoniæ*). To neutralize 1.7 Gm. (1.88 Cc.) of stronger ammonia water should require 28 Cc. of normal sulphuric acid (each cubic centimeter corresponding to 1 per cent of ammonia), rosolic acid being used as indicator"—(*U. S. P.*).

Action and Medical Uses.—Undiluted, this stronger water of ammonia is entirely too potent for medicinal use. Its principal employment is externally as a counter-irritant. The formula for *Gondret's Ammoniacal Ointment* as improved is as follows: Take of lard, 16 drachms, oil of sweet almonds, 1 drachm; melt the lard and mix it with the oil in a wide-mouthed vial with a glass stopper; then add aqua ammoniæ fortior, specific gravity 0.901, 8½ drachms; close the bottle, mix the contents by agitation, and keep in a cool place. Rubbed on the skin it causes rubefaction, but if covered by a compress it speedily produces vesication. If well prepared, vesication will take place in from 8 to 12 minutes. In cases of poisoning from swallowing this stronger water of ammonia, the means to be used are the same as named above for the weaker solution (see also *Aqua Ammoniæ*).

AQUA AMYGDALÆ AMARÆ (U. S. P.)—BITTER ALMOND WATER.

Preparation.—"Oil of bitter almond, one cubic centimeter (1 Cc.) [16 ♏]; distilled water, nine hundred and ninety-nine cubic centimeters (999 Cc.) [33 fl℥, 374 ♏], to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the oil in the distilled water by agitation, and filter through a well-wetted filter"—(*U. S. P.*).

This medicated water soon undergoes decomposition, on which account it should only be prepared as required, and never in large quantities. It is a sedative, of the character of hydrocyanic acid, and is preferable to the distilled water of bitter almonds; which is more dangerous in its effects upon the system, and which is sold under the same name; great care is required to distinguish between these two preparations in dispensing prescriptions.

Action, Medical Uses, and Dosage.—Bitter almond water may be used in all cases where hydrocyanic acid or its sedative compounds are useful, as in *whooping-cough*, *pulmonary affections*, etc. It is more commonly used as an addition to other medicines to impart its peculiar flavor to them. The dose of bitter almond water, when freshly made, is from 1 to 2 fluid drachms, which may be repeated 2 or 3 times daily. Care should be had not to confound this preparation with some of the European preparations which are much stronger. Even this is uncertain in strength, and not very safe as a remedy.

AQUA ANETHI.—DILL WATER.

Preparation.—"Dill fruit, bruised, 1 pound; water, 2 gallons. Distill 1 gallon"—(*Br. Ph.*). Imperial measure.

History, Action, Medical Uses, and Dosage.—This water is but little used in America. It is slightly opalescent when first made, and resembles anise water in odor and taste. It may be administered in *infantile colic*. When administered to a nursing mother it is said to impart its flavor to the milk. The dose is from 1 fluid drachm to 1 fluid ounce.

AQUA ANISI (U. S. P.)—ANISE WATER.

Preparation.—"Oil of anise, two cubic centimeters (2 Cc.) [32 ♏]; precipitated calcium phosphate, four grammes (4 Gm.) [62 grains]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the oil of anise with the precipitated calcium phosphate, add the water gradually, under constant trituration, and filter"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Used principally as a pleasant vehicle for the administration of magnesia, and such cathartics as jalap, rhubarb, and senna, to modify their griping action. It is useful also as a carminative to expel flatus in *flatulent colic*, and *indigestion* accompanied with gaseous accumulations. The dose is from 2 fluid drachms to 1 fluid ounce.

AQUA AURANTII FLORUM (U. S. P.)—ORANGE FLOWER WATER.

Preparation.—"Stronger orange flower water, distilled water, of each, 1 volume. Mix them immediately before use"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This water is employed chiefly as a delicately perfumed vehicle for other substances. As a medicine, it has little to recommend it, though it has been administered in *cardiac palpitations*, and *headaches* of a neuralgic character in nervous females. It has likewise been employed in various *hysteroidal affections*.

AQUA AURANTII FLORUM FORTIOR (U. S. P.)—STRONGER ORANGE FLOWER WATER.

SYNONYMS: *Aqua aurantii florum* (*Pharm.* 1880), *Triple orange flower water.*

Source, History, and Tests.—"Water saturated with the volatile oil of fresh orange flowers, obtained as a by-product in the distillation of the oil of orange flowers. It should be kept in loosely-stoppered bottles, in a dark place. Stronger orange flower water should be neutral to litmus paper, and possess a strong odor of fresh orange flowers. It should be colorless and clear, or only faintly opalescent, not mucilaginous, and give no reaction with hydrogen sulphide T.S. or ammonium sulphide T.S. (absence of metallic impurities)"—(*U. S. P.*).

Eau de fleurs d'Oranger, of the French, was prepared by taking orange flowers, 10 parts, and water, 30 parts, and distilling therefrom 20 parts. If in this manner 2 pounds of orange flower water are obtained from each pound of flowers employed, the product is called *double orange flower water;* if pound for pound is obtained, it is *quadruple orange flower water;* if 3 pounds are obtained from 2 pounds of flowers, it is *triple orange flower water;* if the *double* be cut with an equal amount of water it produces *simple orange flower water* (Jourdan, *Pharmacopée Universelle*, 1840).

Description and Uses.—Orange flower water (distilled) is a clear, colorless, and agreeably aromatic liquid, having an odor and taste distinct from that prepared from oil of neroli (oil of orange flowers). It may be faintly opalescent. A mucilaginous material sometimes separates from the commercial water, which may be removed by filtration, after being previously agitated with pulverized kaolin. Should it become acid in reaction, distilling from magnesia will restore it to its normal condition. It is used in preparing *Aqua Aurantii Florum.*

AQUA CAMPHORÆ (U. S. P.)—CAMPHOR WATER.

Preparation.—"Camphor, eight grammes (8 Gm.) [123 gr.]; alcohol, five cubic centimeters (5 Cc.) [81 ♏]; precipitated calcium phosphate, five grammes (5 Gm.) [77 gr.]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the camphor with the alcohol and precipitated calcium phosphate, then with the water gradually added, and filter"—(*U. S. P.*).

The first trituration with alcohol, by destroying the tenacity with which the particles of camphor adhere together, renders it more readily pulverizable; the second trituration with the calcium salt subdivides it still more finely, so that the water can more readily act upon it, and produce the desired medicated water. The filtration removes the calcium phosphate and excess of camphor from the solution. Ice-cold water will dissolve more camphor than water at the ordinary temperature.

Action, Medical Uses, and Dosage.—Camphor water is a very feeble preparation of camphor, and is principally used as a vehicle for the administration of some other remedies. It has, however, been useful in the *typhoid stage of febrile diseases* to produce sleep and quietness, also to relieve severe *after-pains, colic, mild neuralgic pains, dysmenorrhœa* in nervous individuals, *singultus, nervous debility*, and in all cases where small doses of camphor are indicated. Its dose varies from ½ fluid ounce to 2 fluid ounces every 1, 2, or 3 hours, as circumstances require. Externally, it has been found useful in *chronic ophthalmia*, in combination with rose water, infusion of golden seal, etc.

AQUA CARUI.—CARAWAY WATER.

Preparation.—Prepare caraway water in the same manner as cinnamon water on page 247, using oil of caraway instead of oil of cinnamon.

Action, Medical Uses, and Dosage.—The properties, uses, and dose of caraway water are the same as for anise water. It has a strong odor of caraway.

AQUA CHLORI (U. S. P.)—CHLORINE WATER.

"An aqueous solution of chlorine (Cl=35.37), containing at least 0.4 per cent of the gas"—(*U. S. P.*).

Preparation.—"Manganese dioxide, ten grammes (10 Gm.) [154 grs.]; hydrochloric acid, thirty-five cubic centimeters (35 Cc.) [1 fl℥, 98 ♏]; water, seventy-five cubic centimeters (75 Cc.) [2 fl℥, 257 ♏]; distilled water, four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏]. Place the dioxide in a flask connected by a suitable tube with a small wash bottle containing fifty cubic centimeters (50 Cc.) [1 fl℥, 331 ♏] of water, and connect this with a bottle having a capacity of one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and containing four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of distilled water which has previously been boiled and allowed to cool. Add to the dioxide in the generating flask the hydrochloric acid, previously diluted with twenty-five cubic centimeters (25 Cc.) [409 ♏] of water, and, by means of a sand-bath, apply a gentle heat. Conduct the generated chlorine through the water contained in the wash-bottle into the bottle containing the distilled water, which should be loosely stopped with cotton and kept, during the operation, at a temperature of about 10° C. (50° F.). When the air has been entirely displaced by the gas, disconnect the bottle from the apparatus, and, having inserted the stopper, shake the bottle, loosening the stopper from time to time, until the gas ceases to be absorbed. If necessary, reconnect the bottle with the apparatus, and continue passing the gas, and agitating, until the distilled water is saturated. Finally, pour the chlorine water into small, dark amber-colored, glass-stoppered bottles, which should be completely filled therewith, and keep them in a dark and cool place. Chlorine water, even when kept from light and air, is apt to deteriorate. When it is required of full strength, it should be freshly prepared"—(*U. S. P.*).

In the preparation of chlorine and chlorine water, the operator should be cautious not to inhale the gas, as it is a very poisonous irritant to the respiratory mucous surface. In case such an accident should occur, ammonia water, or carbon disulphide, should be cautiously inhaled. Care should also be taken not to inhale sufficient of these compounds to produce poisonous effects.

Description.—"A clear, greenish-yellow liquid, having the suffocating odor and disagreeable taste of chlorine, and leaving no residue on evaporation. It instantly decolorizes dilute solutions of litmus, indigo, and other vegetable coloring matters. When shaken with an excess of mercury until the odor of chlorine has disappeared, the remaining liquid should be at most but faintly acid (limit of hydrochloric acid). On adding 17.7 Gm. of chlorine water to a solution of 1 Gm. of potassium iodide in 10 Cc. of water, the resulting deep-red liquid should require, for complete decoloration, not less than 20 Cc. of decinormal sodium hyposulphite V.S. (corresponding to at least 0.4 per cent of chlorine)"—(*U. S. P.*).

Chlorine water, formerly called *oxymuriatic acid*, has an astringent, nauseous taste, and possesses all the bleaching and oxidizing properties of the gas. It has no acid reaction, unless it has been exposed to light. With water near its freezing point, it combines and forms a crystalline hydrate of a pale, yellowish-green color, which Faraday found to contain 27.7 per cent of chlorine. This practically corresponds to the formula Cl_2+10H_2O.

Action, Medical Uses, and Dosage.—Chlorine water is a powerful antiseptic, destroying foul and noxious effluvia, and also acts upon the system as a stimulant. It has been used internally in *chronic hepatitis*, *typhus*, *cynanche maligna*, and *scarlet fever*, in doses of 1 or 2 fluid drachms largely diluted with water, and repeated 2 or 3 times a day. Diluted with water, it has been employed as a gargle in the throat affections attending the *exanthemata*, in *putrid affections* of the mouth and throat; as a wash or local application in *indolent*, *gangrenous*, and *carcinomatous ulcerations*, in *indolent abscesses*, *buboes*, and *fistulous ulcers*. In *hepatic diseases* its internal should be associated with its external use, bathing around and over the region of the liver. Chlorine gas inhaled in small quantity has been found serviceable in *chronic catarrh*, *chronic bronchitis*, and even in *phthisis*. At first, expectoration is augmented, but eventually it decreases with marked improvement in the general health. Ten or twenty drops of chlorine water may be placed in 2 or 3 fluid drachms of water in a glass inhaler, to which add 1 or 2 minims of sulphuric acid. Upon placing this in a water-bath at 37.7° C. (100° F.), the chlorine gas will be driven off, and may be inhaled by the patient for several minutes, repeating the operation several times a day (C.—Elliottson). A solution of from 5 to 10 minims, applied by atomization, would be preferable to the latter methods. However, it is now seldom employed in pulmonary complaints. Its best use is in *fetid* local troubles requiring a deodorizer and powerful disinfectant. Dose from 1 to 4 fluid drachms largely diluted. In large doses it is an irritant poison. The treatment after emesis consists in administering albumen, milk, veal and other animal broths, a thin mixture of lime-water, or flour and water, etc.

Chlorine ($Cl=35.37$).—*Chlorine* occurs in nature only in combination, principally in common salt (sodium chloride), of which it constitutes about 60 per cent. It is therefore a prominent constituent of sea-water. It was discovered in 1774 by Scheele, who named it "*dephlogisticated muriatic acid*" and "*oxymuriatic acid.*" Chlorine was proved to be an element by H. Davy in 1810. Chlorine gas may be prepared in several ways beside that indicated under *Aqua Chlori.* It is usually obtained by the interaction of diluted sulphuric acid, sodium chloride, and manganese dioxide, according to the following equation: $2NaCl+3H_2SO_4+MnO_2=MnSO_4+2NaHSO_4+2H_2O+Cl_2$. Chlorine gas is prepared on a large scale in the manufacture of bleaching powder by various processes (see *Calx Chlorata*). Chlorine gas is of a greenish-yellow color, with a pungent and suffocating odor, a peculiar and somewhat astringent taste, and is highly irritating when respired, exciting cough and great irritation of the lungs, even when considerably diluted with common air. In more concentrated state it may produce hemoptysis, with intense pain, and even death may result. It has the specific gravity 2.48. Under a pressure of 6 atmospheres at 0° C. (32° F.), or subjected to a temperature of —34° C. (—42.8° F.), at ordinary pressure, chlorine gas is condensed into a bright-yellow liquid of specific gravity 1.33. Water at 15.5° C. (60° F.) dissolves twice its volume of the gas. It unites with many metals under combustion to form *chlorides*; also with organic compounds. On account of its great affinity for hydrogen, it acts as a powerful bleaching agent in the presence of moisture. It is a powerful, diffusible disinfectant.

AQUA CHLOROFORMI (U. S. P.)—CHLOROFORM WATER.

Preparation.—"Chloroform, distilled water, each a sufficient quantity. Add enough chloroform to a convenient quantity of distilled water contained in a dark amber-colored bottle, to maintain a slight excess of the former, after the contents have been repeatedly and thoroughly agitated. When chloroform water is required for use, pour off the needed quantity of the solution, refill the bottle with distilled water and saturate it by thorough agitation, taking care that there be always an excess of chloroform present"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Chloroform water is an agreeable vehicle for the administration of other medicines, and is particularly useful in *non-inflammatory diarrhœa*, *flatulent colic*, *gastralgia*, and other forms of *abdominal pain*. It is a stimulant to mucous surfaces, and is useful as a gargle and mouth wash. On account of its preservative qualities, it is valuable in solutions containing organic materials, which, without some antifermentative, would undergo decomposition. Medicinal mixtures to be used in a few days may be preserved by it in summer time. It forms a pleasant vehicle for cough mixtures, and it alone is useful in *coughs* characterized by tickling, irritation, or other nervous sensations in the bronchiæ and throat. *Whooping-cough* is palliated by it. It is likewise employed as a local hemostatic, where bleeding is small in amount. Dose, from 1 fluid drachm to 1 fluid ounce.

AQUA CINNAMOMI (U. S. P.)—CINNAMON WATER.

Preparation.—"Oil of cinnamon, two cubic centimeters (2 Cc.) [32 ♏], precipitated calcium phosphate, four grammes (4 Gm.) [62 grs.]; distilled water a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the oil of cinnamon with the precipitated calcium phosphate, add the distilled water gradually, under continued trituration, and filter"—(*U. S. P.*).

When cinnamon water is prepared with true oil of cinnamon, it soon becomes turbid from oxidation of the oil, and the formation of *cinnamic acid* ($C_6H_5.CH{:}CH.COOH$), which crystallizes from the water. Oil of Chinese cinnamon yields a water remaining clear for a much longer time.

Action, Medical Uses, and Dosage.—Cinnamon water is useful in *passive hemorrhage* from the *lungs*, *stomach*, *kidneys*, or *uterus*, in *chronic diarrhœa* and *dysentery*, and in *flatulency*. It is frequently employed to cover the unpleasant taste of other remedies, especially opiates, and will often allay vomiting. Its dose is from 2 fluid drachms to 2 fluid ounces. It should not be used when fever or inflammation is present.

AQUA CREOSOTI (U. S. P.)—CREOSOTE WATER.

Preparation.—"Creosote, ten cubic centimeters (10 Cc.) [162 ♏]; distilled water, nine hundred and ninety cubic centimeters (990 Cc.) [30 fl℥, 229 ♏], to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Agitate the creosote vigorously with the distilled water, and filter through a well-wetted filter"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Creosote water may be employed as a lotion where the discharges are fetid, ichorous, and profuse, as in *ulcers*, *burns*, and *gangrene*. It may also be used advantageously in catarrhal states, as *leucorrhœa* and *gleet*, and in some forms of skin diseases, especially *sycosis* and *prurigo*. Internally, it may be given in *obstinate singultus*, *diabetes*, and *chronic pulmonic complaints* with profuse and offensive secretions. The dose is from 1 to 4 fluid drachms.

AQUA DESTILLATA (U. S. P.)—DISTILLED WATER.

FORMULA: H_2O. MOLECULAR WEIGHT: 17.96.

Preparation.—"Water, one thousand volumes (1000 vol.), to make eight hundred volumes (800 vol.). Distill the water from a suitable apparatus provided with a block-tin or glass condenser. Collect the first one hundred volumes (100 vol.), and throw this portion away. Then collect eight hundred volumes (800 vol.) and keep the distilled water in glass-stoppered bottles, rinsed with hot distilled water immediately before being filled"—(*U. S. P.*).

Description and Tests.—"A colorless, limpid liquid, without odor or taste, and perfectly neutral to litmus paper. The transparency of distilled water should not be affected, nor should any color be imparted to it, by test solutions of hydrogen sulphide or ammonium sulphide (absence of metallic impurities), or by those of barium chloride (sulphates), silver nitrate (chlorides), ammonium oxalate (calcium), or mercuric chloride (ammonia); nor should its transparency be affected when mixed with twice its volume of calcium hydrate T.S. (absence of carbonic acid). It should give no reaction for nitrates or nitrites when tested as described under Water (see *Aqua*). When 1000 Cc. of distilled water are evaporated on a water-bath to dryness, no residue should remain. On heating 100 Cc. of distilled water acidulated with 10 Cc. of diluted sulphuric acid, to boiling, and subsequently adding 1 Cc. of centi-normal potassium permanganate V.S., the color of the liquid should not be completely destroyed by boiling for 10 minutes, nor by afterwards setting the vessel aside, well covered, for 10 hours (absence of organic or other oxidizable matters)"—(*U. S. P.*).

The demand of the *U. S. P.* that 1000 Cc. of distilled water, evaporated on a water-bath to dryness, should leave no residue, is probably impossible to strictly comply with. The amount of residue which good distilled water may leave upon evaporation, should not exceed 1 part in 100,000 (*Am. Jour. Pharm.*, 1896, p. 187). Distilled water is apt to become contaminated with fresh water algæ (confervæ).

In many pharmaceutical and chemical processes, distilled water is very essential, while in others, pure spring or river, or rain water, will be sufficient. The reason for throwing away the first 100 parts which are distilled over, is that any volatile principles which may be present, as ammonia, carbonic acid gas, etc., and which may pass over with the first portions, may be removed. The last 100 parts, left in the still, contain the residual impurities, and if allowed to pass over might give to the product an empyreumatic odor and taste. Carbon dioxide will be absorbed by distilled water if the latter be exposed to the atmosphere for any considerable time. In this case lime-water will occasion turbidity in the distilled water. Distilled water is nearly always employed in making the medicated waters, in diluting acids, and in making solutions of various salts, as the alkaloidal salts, silver nitrate, permanganate of potassium, etc. For other uses, see *Aqua*.

AQUA FŒNICULI (U. S. P.)—FENNEL WATER.

Preparation.—"Oil of fennel, two cubic centimeters (2 Cc.) [32 ♏]; precipitated calcium phosphate, four grammes (4 Gm.) [62 grs.]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the oil of fennel with the precipitated calcium phosphate, add the distilled water gradually, under continued trituration, and filter"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Fennel water is a pleasant aromatic stimulant and carminative; and may be added to other medicines to render them more agreeable. It may be employed for *gastric acidity* and *flatulent colic*. The dose is from 1 fluid drachm to 1 fluid ounce.

AQUA HAMAMELIDIS.—HAMAMELIS WATER.

SYNONYMS: *Distilled hamamelis, Distillate of hamamelis, Distilled witch-hazel, Witch-hazel extract.*

Preparation—Take of the green leaves and young twigs of witch-hazel, any convenient amount. Place them in a copper still and cover them with a mixture of alcohol, 1 part, water, 9 parts. Boil by direct fire and recover 2 parts of distillate for each part of leaves employed. For commercial purposes very inferior preparations are made in which the alcohol is decreased, and the distillate increased.

Uses.—(See *Hamamelis*).

AQUA HAMAMELIDIS SPIRITUOSA (*N. F.*).—*Hamamelis water, Witch-hazel water, Witch-hazel extract. Formulary number,* 10. "Hamamelis, shoots and twigs, ten thousand grammes (10,000 Gm.) [22 lbs. av., 323 grs.]; water, twenty thousand cubic centimeters (20,000 Cc.) [5 Cong., 3 fl℥, 30 ♏]; alcohol, fifteen hundred cubic centimeters (1500 Cc.) [50 fl℥, 345 ♏]. Place the hamamelis in a still, add the water and alcohol, and allow the mixture to macerate during 24 hours. Distill ten thousand cubic centimeters (10,000 Cc.) [2 Cong., 8 fl℥, 102 ♏], by applying direct heat, or preferably, by means of steam."

Note.—"This preparation should be made only from the fresh young twigs of hamamelis, which are collected for this purpose, preferably when the plant is in flower, in the late autumn of the year"—(*Nat. Form.*).

AQUA HEDEOMÆ.—PENNYROYAL WATER.

Preparation.—Triturate oil of American pennyroyal, ½ fluid drachm, with precipitated calcium phosphate, 1 drachm, then with distilled water, 2 pints, to be gradually added; finally, filter through paper.

Action, Medical Uses, and Dosage.—Pennyroyal water may be used as a substitute for, and in the same doses as peppermint and spearmint waters. Some persons prefer it.

AQUA HYDROGENII DIOXIDI (U. S. P.)—SOLUTION OF HYDROGEN DIOXIDE.

"A slightly acid, aqueous solution of hydrogen dioxide (H_2O_2=33.92), containing, when freshly prepared, about 3 per cent, by weight, of the pure dioxide, corresponding to about 10 volumes of available oxygen"—(*U. S. P.*).

SYNONYM: *Solution of hydrogen peroxide.*

History and Preparation.—Dioxide of hydrogen was discovered in 1818, by M. Thénard, and named *oxygenated water.* It is produced when peroxide of potassium, sodium, barium, strontium, or calcium, is digested with any acid that forms a salt with the base. Thénard prepared it by acting upon barium dioxide (peroxide of barium) with diluted hydrochloric acid, thus: $BaO_2+2HCl=H_2O_2+BaCl_2$; and afterward separating the barium chloride by the cautious addition of sulphate of silver. Clermont reported finding it in the juices of a great variety of plants, but the experiments of Belluci failed to support him. Struve states that the combustion of hydrogen in the atmosphere produces hydrogen dioxide, together with ozone and ammonium nitrite. Struve and others report that it is often present in the atmosphere, in rain-water, and in snow; Houzeau failed in his first attempt to find it in rain-water, but afterward discovered it in snow, at Rouen (*Compt. Rend.* lxx, 519). At the present time hydrogen dioxide is made by decomposing hydrated barium dioxide with sulphuric acid, as follows: Freshly prepared hydrated dioxide of barium is gradually added to a *cold* mixture of sulphuric acid and water (not less than 5 of water to 1 of acid) until the mixture becomes very slightly acid; the sulphate of barium is then separated by filtration; the excess of sulphuric acid in the filtrate is now removed, by the cautious addition of dilute baryta solution; again filtered; and the aqueous solution of hydrogen dioxide concentrated in vacuo over sulphuric acid: $BaO_2.8H_2O+H_2SO_4=BaSO_4+H_2O_2+8H_2O$. When the solution becomes more concentrated, an addition of a small amount of sulphuric acid will give it more stability (Thénard).

The official solution of hydrogen dioxide is prepared as follows: "Barium dioxide, three hundred grammes (300 Gm.) [10 oz. av., 255 grs.]; phosphoric acid, diluted sulphuric acid, distilled water, of each, a sufficient quantity. Pour five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of cold distilled water into a suitable bottle, add to it the barium dioxide in such a way that it shall not form lumps, and shake vigorously so that a uniform mixture may result. Provide suitable means of refrigeration, so that the bottle and contents may be kept at a temperature below 10° C. (50° F.), and shake it thoroughly every few minutes during half an hour. Afterwards, continuing the refrigeration, shake it occasionally, but vigorously, until the dioxide has become fully hydrated, which may be recognized from the fact that only a small portion of the water separates from it on standing, and that it may be mixed with the separated water without great effort by shaking. Having introduced ninety-six cubic centimeters (96 Cc.) [3 fl℥, 118 ♏] of phosphoric acid into a bottle having the capacity of about two thousand cubic centimeters (2000 Cc.) [67 fl℥, 302 ♏], add to it three hundred and twenty cubic centimeters (320 Cc.) [10 fl℥, 394 ♏] of distilled water, cool the mixture, and remove fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏], as a reserved portion. Now add the well-mixed magma, in about four portions, to the acid liquid, and mix them intimately by vigorous and continuous shaking, cooling the bottle after each addition of magma. From time to time test the reaction of the liquid, and, when it becomes alkaline, add to it, cautiously, a little of the reserved phosphoric acid, until the liquid has again acquired an acid character. Repeat the agitation from time to time, and also the cautious addition of phosphoric acid, as long the liquid becomes alkaline on prolonged, vigorous shaking. If necessary, a further quantity of phosphoric acid should be diluted with distilled water, in the proportion above given, and a portion of this liquid used for saturation. Having finally shaken the bottle again very thoroughly, and until the liquid part is neutral to litmus paper, set it aside until the precipitate occupies only about one-third of the volume of the contents, and pour the supernatant liquid upon a wetted, double, rapidly-acting, white filter, of a diameter of 30 centimeters (11.8 inches). Then transfer the semi-liquid precipitate to the filter, rinse the bottle with one hundred cubic centimeters (100 Cc.) [3 fl℥, 181 ♏] of distilled water, transfer this to the filter, and when the liquid has drained off, wash the barium phosphate on the filter with distilled water, until the filtrate measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Now add to it, first, 20 drops, and afterwards, if necessary, further, smaller quantities of diluted sulphuric acid, until a small portion of the liquid, after filtration (which may be assisted by a little starch), is no longer rendered cloudy by diluted sulphuric acid. Mix the cloudy liquid with about ten grammes (10 Gm.) [154 grs.] of starch by agitation, so that the starch may be thoroughly distributed, throughout the liquid, and then filter it through a well-wetted, white filter, of a diameter of 25 centimeters (9.8 inches), returning the first portions until it runs through clear. When all the liquid has passed, ascertain the percentage of hydrogen dioxide contained in it by the method of assay given below, and dilute the remaining liquid if necessary, so that it will contain 3 per cent of absolute hydrogen dioxide. Keep the product in loosely-stoppered bottles, in a cool place. Since solution of hydrogen dioxide will gradually diminish in strength, even when carefully kept, it should either be freshly made when wanted, or be kept on hand only in such quantity as will probably be consumed within a short time. Any solution which has become weaker, need not, for this reason, be thrown away, but may be reserved for an occasion when a weaker or diluted solution is prescribed or demanded. Or, it may be employed, when making a fresh supply, as a diluent of the stronger solution"—(*U. S. P.*).

Description.—Concentrated hydrogen dioxide is a colorless, odorless, oily appearing liquid, of sp. gr. 1.452, and does not solidify at —30° C. (—22° F.) (Thénard); it evaporates in vacuo at ordinary temperatures, without decomposition, and does not redden, but bleaches, litmus and turmeric paper; it has an astringent, bitter taste; when applied to the skin it first bleaches, and subsequently develops a white blister, accompanied with violent itching, followed by painful irritation. It mixes in all proportions with cold water, and when a solution, containing eight times its volume of oxygen, is heated to 50° C. (122° F.), the oxygen begins to be evolved, ebullition increases, and upon ceasing, water only remains. Concentrated hydrogen dioxide evolves oxygen slowly at 20° C. (68° F.), but if quickly heated to 100° C. (212° F.), the separation is violent, and sometimes explosive (R. and S.). It is also decomposed with almost explosive violence when in contact with finely-divided metals, as gold, silver, and platinum, the metals remaining unaltered. The oxides of these metals are decomposed by, and in turn decompose, hydrogen dioxide; the metals being reduced to a metallic state, and free oxygen liberated; thus we have a powerful oxidizing agent which acts as a reducer. In other instances, hydrogen dioxide transforms many basic oxides into higher oxides. With solution of ferrocyanide of potassium it forms ferricyanide of potassium; with solution of ferrous sulphate it forms ferric sulphate. Manganese sulphate in alkaline solution is oxidized to manganese dioxide by hydrogen peroxide, while in acid solution manganese dioxide is reduced by it to a manganous salt under evolution of oxygen. An aqueous solution of hydrogen dioxide is used to clean and bleach old engravings and oil paintings, and, according to Cameron, the popular colorless solution perniciously employed to change dark hair to yellow is this substance.

Official solution of hydrogen dioxide is described as "a colorless liquid, without odor, slightly acidulous to the taste, and producing a peculiar sensation and soapy froth in the mouth; liable to deteriorate by age, exposure to heat, or protracted agitation. Specific gravity about 1.006 to 1.012 at 15° C. (59° F.). When exposed to the air at the ordinary temperature, or when heated on a water-bath at a temperature not exceeding 60° C. (140° F.), the solution loses chiefly water. When rapidly heated, it is liable to decompose suddenly. Solution of hydrogen dioxide has an acid reaction, due to a small amount of free acid purposely allowed to remain in it for preservation"—(*U. S. P.*). Solution of hydrogen dioxide should be kept well corked and in a cool, dark place.

Tests.—When a solution of ferrous sulphate is mixed with phenol, the addition of a small amount of hydrogen dioxide, gives a green color; of a large amount, a dark-green precipitate. According to Parnell, the test will fail if the phenol be added after the admixture with hydrogen dioxide. Hydrogen dioxide liberates iodine from a solution of iodide of potassium and ferrous sulphate (Schönbein), a reaction so delicate as to form the blue iodide of starch, when but 1 part of hydrogen dioxide is present in 25,000,000 parts of solution. Another delicate reaction is that based on the formation of perchromic acid, as described under the *U. S. P.* tests which are as follows:

"On adding to 10 Cc. of water, in a test-tube, 1 drop of potassium chromate T.S., then 10 drops of diluted sulphuric acid, and pouring a few cubic centimeters of ether on top, the subsequent addition of a few drops of solution of hydrogen dioxide, even when considerably diluted, will cause a blue color to appear at the zone of contact of the two liquids. After shaking, the ethereal layer will separate with a blue color. Upon evaporating 50 Cc. of the solution to dryness, on a water-bath, not more than 0.25 Gm. of residue should remain. Upon evaporating 50 Cc. of the solution, previously rendered alkaline by sodium hydrate T.S., to dryness, transferring the dry residue to a watch-glass, moistening it with sulphuric acid, and setting the glass in a moderately warm place for a few hours, the surface of the glass, after being washed, should exhibit no sign of corrosion (absence of hydrofluoric acid). Fifty Cc. of the solution should not require more than 0.5 Cc. of potassium hydrate V.S. to render the liquid alkaline, phenolphtalein being used as indicator (limit of free acid). The addition of a few drops of diluted sulphuric acid to 10 Cc. of the solution should produce no turbidity or precipitate (absence of barium)"—(*U. S. P.*).

Valuation of Solution of Hydrogen Dioxide.—"Dilute 10 Cc. of the solution with water to make 100 Cc. Transfer 17 Cc. of this liquid (containing 1.7 Cc. of the solution) to a beaker, add 5 Cc. of diluted sulphuric acid, and then, from a burette, decinormal potassium permanganate V.S., until the liquid just retains a faint pink tint after being stirred. Each cubic centimeter of the decinormal potassium permanganate V.S. corresponds to 0.0017 Gm. of absolute hydrogen dioxide. To express the strength of any solution of hydrogen dioxide approximately in volumes of available oxygen (that is, in volumes of oxygen, given off by 1 volume of the solution upon decomposition), multiply the number of cubic centimeters of decinormal permanganate V.S. decolorized by 1 Cc. of the solution, by 0.56 (0.5594); or those decolorized by 1.7 Cc. of the solution, by 0.33. (It is assumed that 1000 Cc. of oxygen, at 0° C. [32° F.] and 760 Mm. pressure, weigh 1.43 Gm.) To express the strength in percentage (by weight) of absolute hydrogen dioxide, multiply the number of cubic centimeters of decinormal permanganate V.S. decolorized by 1 Cc. of it, by 0.17; or divide the number of cubic centimeters of permanganate V.S. decolorized by 1.7 Cc. of it, by 10"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This agent was introduced to the profession as a therapeutical means, by Dr. B. W. Richardson, of London, England (1860). From experiments instituted by him, he found that certain animal substances when brought into contact with a solution of peroxide of hydrogen, liberated its oxygen, as was the case with fibrin, carbonic acid, etc. The presence of free oxygen in the system must act as a stimulant, oxygenate the blood, and antagonize *septic conditions;* he, therefore, recommended its employment, therapeutically, in all cases marked by deficient oxidation; as an antidote to various *poisons;* in *low fevers*, and in all cases manifesting deficient oxidation; in *diabetes, tetanus*, and *cancer*. Subsequently, from a larger experience, he advised it as useful in *chronic rheumatism*, in *scrofulous tumors* and *abscesses*, in *pertussis* to mitigate the paroxysms, in the *dyspnœa* attending *chronic bronchitis*, and in *poisoning by narcotics*. He recommended that the solution employed should be charged with 10 volumes of oxygen, which could be readily determined by an estimate of the amount of oxygen present in the peroxide of barium employed in its manufacture; and of this preparation the dose varies from 1 to 4 fluid drachms, largely diluted with water, to be repeated 3 or 4 times daily. Richardson later stated that nothing except a change of air acted as quickly in checking *whooping-cough*. Both the aqueous solution and the ethereal solution (*ozonic ether*) have been employed internally, and the various experimenters with this agent, since its introduction, differ greatly in their views as to any therapeutical efficacy it may possess. It is altogether probable that the agent is destroyed in the stomach, so that but little of it as peroxide can enter into the system. As a remedy for *diabetes*, a disease in which it was once thought to be of particular value, it has entirely fallen into discredit. It is occasionally used as a test for blood stains.

It is its importance as a topical disinfectant and pus destroyer that gives peroxide of hydrogen its value in therapy at the present time. It is undoubtedly one of the best antiputrefactive agents in use. It is of value, however, only when putrefaction has already set in, and is of little or no value as a preventative of such changes, owing to its liability to decomposition. When brought into contact with the mucous tissues or ulcerations, it immediately coagulates the albuminous material and leaves a whitish coating on the parts, doing no injury, however, to the tissues. At the same time gas is copiously evolved as shown by the frothing which ensues, and particularly if pus be present. It stands unrivalled as a pus destroyer, and, being unirritating, may be poured upon pus-bathed surfaces or into the body cavities, when prompt effervescence will ensue, with the liberation of oxygen, and when the commotion has ceased, the cavity will be free from pus. Ordinarily the agent causes no pain, but in small cavities, as in the ear, nasal fossæ, and urethra, the sudden distension of the parts by the rapid evolution of the gas may occasion pain, if not other injury, to the parts. It is applicable to all forms of *wounds* and *ulcerations* as a local disinfectant and antiseptic. *Putrid surfaces and discharges* call for it. Pus cells are found to shrivel, become granular, and break down after having been in contact with the solution. It promptly destroys many of the bacteriæ. *Syphilitic chancre* is said to be destroyed by it, but this is probably claiming too much for it. It does, however, improve the condition of *syphilitic ulcers*, as well as those of a tuberculous or scrofulous character. *Mammary abscesses* may be cleansed with it, and it may be poured or injected into other *abscesses, sinuses, fistulæ*, and upon sluggish, *fetid ulcerations* and *carbuncles*. As a spray it may be used in an atomizer upon the membranes of the throat and nose, and especially where fetor and pus are present, in *ulcerative tonsillitis, scarlatinal angina, ozena, chronic nasal catarrh*, and in *fetid bronchial secretions* and *fetid breath* from local causes. In *diphtheria* it has been highly valued, and particularly after the membrane has become detached. In this disease the remedy should also be given internally in teaspoonful doses of a

15-volume solution (100 parts) mixed with glycerin (1½ parts). Owing to its bleaching properties it has been successfully used to remove *morph.*

In the puerperal state when the lochia becomes putrid and the temperature leaps high, and there is great excitation, the ushering in of a *puerperal septicæmia*, no better cleansing agent can be used than solution of hydrogen dioxide. With appropriate remedies it will greatly assist in preventing a fatal issue. In *gonorrhœa*, *leucorrhœa*, *cystitis*, and other genito-urinary states in which pus is contained in the secretions, it makes a safe and efficient wash. In *purulent conjunctivitis* it quickly destroys the pus, and irrigation of the sac in *dacrocystitis* is often followed by a prompt cure. Foltz states that he has been disappointed with it in the *suppurative diseases of the ear* in which it has been so highly praised. With him the "dry treatment" has yielded prompter results. The *stings* of insects are rendered painless by spraying the solution upon the parts.

Hydrogen peroxide is on the market in 10 and 15 volume solutions in water. Of the 10-volume preparation from 1 to 4 fluid drachms largely diluted may be given internally 3 times a day after meals; as a spray and gargle take 2 fluid ounces of the 15-volume solution in 14 ounces of water; for other local uses, a wash of from 3 to 10 fluid ounces of the 10 or 15 volume peroxide to 16 fluid ounces of water.

Related Substances.—OZONE (see *Ozone*) has been proposed as a disinfectant of the air, but it has been shown that before pathogenetic bacteria and other low forms of life are affected by it, the atmosphere must be so saturated with it as to render it irrespirable.

OZONIC ETHER.—A fairly stable, but very inflammable solution of hydrogen dioxide in ether, introduced by Richardson and used as an internal agent.

HYDROZONE.—Manufactured by Charles Marchand, Chemist, of New York City. It is a concentrated preparation of preserved hydrogen peroxide, containing 9 per cent of anhydrous hydrogen dioxide (H_2O_2), and yields not less than 30 volumes of available nascent oxygen. It has a feebly acid taste, and should not be neutralized before using. With ordinary care it does not lose more than $\frac{1}{10}$ of 1 volume every 30 days, at a temperature not exceeding 21.1° C. (70° F.); therefore it is quite a stable preparation. It is intended for use in the same conditions for which hydrogen peroxide is valued, but on account of its high degree of concentration is best adapted when an immediate and more decided antiputrefactive and germicidal agent is required.

GLYCOZONE.—Manufactured by Charles Marchand, Chemist, New York City. It is a stable chemical compound resulting from the chemical reaction which takes place when C. P. glycerin is submitted to the action of 15 times its own volume of ozone. It has a pleasant, sweet, acidulous taste. It absorbs moisture quite rapidly, therefore, it must be kept in well-stoppered containers, to avoid deterioration. Changes do not take place in it below 43.3° C. (110° F.). When tightly corked, so as to retain its anhydrous condition, its healing properties increase with age. It acts similarly but less promptly than hydrozone. In *gastric disorders* it is preferred on account of its kindlier action. It is not poisonous, but it should never come in contact with metallic utensils, like syringes, as it is decomposed thereby. Glass or rubber syringes must be employed. It is successfully applied externally and topically to the throat, rectum, and vagina. Internally it is valued in gastric disorders, being given in 1 or 2 drachm doses in a wineglassful of water, on an empty stomach. In *atonic* and *acid dyspepsia*, *gastric catarrh* and similar affections, it should be given immediately after meals.

AQUA LAUROCERASI.—CHERRY-LAUREL WATER.

Preparation.—Aqua Laurocerasi is prepared, according to the *British Pharmacopœia* (1867), as follows: "Take of fresh leaves of cherry-laurel, 1 pound; water, 2½ pints (50 fl℥); chop the leaves, crush them in a mortar, and macerate them in the water for 24 hours; then distill 1 pint (20 fl℥) of liquid; shake the product, filter through paper, and preserve it in a stoppered bottle"—(*Br.* 1867).

The *French Codex* employs cherry-laurel leaves, ten grammes (10 Gm.) [155 grs.]; water, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; and by a moderate fire distills until fifteen grammes (15 Gm.) [231 grs.] have passed over. The proportion of hydrocyanic acid contained in the cherry-laurel water is determined by means of a titrated solution of cupric sulphate, containing 23.09 Gm. (356 grs.) of this salt, in crystals, to one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of distilled water. The process is as follows: A flat-bottomed glass beaker is placed upon a sheet of white paper, and 10 Cc. cherry-laurel water, with 1 Cc. of aqua ammoniæ, are poured into it. The titrated cupric solution is placed into a burette divided into tenths of a cubic centimeter, from which it is gradually dropped into the liquid in the beaker, and, as soon as the blue coloration is maintained, the number of divisions read upon the burette of the cupric fluid employed, will give exactly, in milligrammes, the proportion of hydrocyanic acid contained in 10 Cc. of the cherry-laurel water experimented with. In this country, cherry-laurel water is often substituted by oil of bitter almond water; as that which is imported is quite variable in strength. In 1875, Mr. W. A. Tilden examined 2½ ounces of the oil that rose upon the surface of cherry-laurel water, and concluded that it consisted chiefly of bitter almond oil, accompanied with less than 2 per cent of hydrocyanic acid, a small portion of another volatile oil, and traces of an odorous resin. Mr. Beringer, in 1890, called attention to commercial specimens containing magnesia, undoubtedly due to preparing the water, not by distillation, but by trituration of the essential oil with magnesia and water (*Amer. Jour. Pharm.*, 1890).

Action, Medical Uses, and Dosage.—This water is employed in the same conditions and maladies as those in which hydrocyanic acid is indicated, in doses of from 5 to 30 minims, administered with prudence and caution; but on account of its uncertain strength it is rarely used in this country, bitter almond water being preferred, as it can readily be prepared as wanted for use (see also *Aqua Amygdalæ Amaræ*).

AQUA MENTHÆ PIPERITÆ (U. S. P.)—PEPPERMINT WATER.

Preparation.—"Oil of peppermint, two cubic centimeters (2 Cc.) [32 ♏]; precipitated calcium phosphate, four grammes (4 Gm.) [62 grs.]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the oil of peppermint with the precipitated calcium phosphate, add the distilled water gradually, under constant trituration, and filter"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Peppermint water is used as an antispasmodic and carminative, in *flatulence* and *flatulent colic*, to allay *nausea* and *vomiting*, and as a gentle aromatic stimulant. The dose is from 4 fluid drachms to 2 fluid ounces, 3 or 4, or more times a day.

AQUA MENTHÆ VIRIDIS (U. S. P.)—SPEARMINT WATER.

Preparation.—"Oil of spearmint, two cubic centimeters (2 Cc.) [32 ♏]; precipitated calcium phosphate, four grammes (4 Gm.) [62 grs.]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the oil of spearmint with the precipitated calcium phosphate, add the distilled water gradually, under constant trituration, and filter"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Similar to those of peppermint water, to which some persons prefer it. The dose is also the same. It is a useful vehicle for potassium acetate and other diuretics.

AQUÆ MINERALES.—MINERAL WATERS.

Mineral Waters (*Aquæ Minerales*) are those which present a large proportion of carbonic acid gas, with or without saline, alkaline, metallic, earthy, gaseous, and other foreign substances, and which exert an appreciable therapeutical influence on the animal economy. The chemical ingredients most frequently present are chloride of sodium, carbonates of sodium and of iron, sulphates of sodium, of magnesium, and of calcium, iodide of sodium, sulphide of hydrogen, carbon dioxide, oxygen and nitrogen. Less frequently found are arsenic compounds, lithium salts, bromide of sodium, free sulphuric acid, fluorides, and organic compounds. The ingredient in excess, or that having the most pronounced action, usually determines the classification. Space permits but a brief notice of a few of the most important mineral springs of this country and Europe. In the United States there are upwards of 250 mineral springs possessing reputed medicinal properties. Many of the springs in this country, if not the majority, are the counterpart of those of Europe. For all practical purposes, they may be appropriately divided into *acidulous*, *chalybeate* or *ferruginous*, *sulphurous*, and *saline mineral waters*, etc. When the water is elevated in temperature the springs are called *Hot* or *Thermal;* when of ordinary temperature or lower, they are called *Cold Mineral Springs.*

I. Acidulous Waters are not so frequently met with as the other forms of mineral waters, from which they are distinguished by holding in solution a *free* acid, other than the carbonic. *Oak Orchard Springs* (Genesee Co., N. Y.), is a representative sulphuric acid spring, containing in a quart, besides sulphates of calcium, iron, magnesium, aluminum and silica, 20.74 grains of free sulphuric acid. Free sulphuric acid is stated, likewise to exist in the *Alum Springs* of Virginia.

II. Chalybeate Waters (*Ferruginous Waters*) contain iron (usually as a bicarbonate, occasionally as a sulphate) as their active principle, and in considerable proportion; they have a styptic taste, and become purplish-black with tannic or gallic acids. When the water contains ferrous salts, the addition of ferrocyanide of potassium causes a white precipitate, which on exposure to the air becomes blue; when the higher salts of iron are contained in the water, ferrocyanide of potassium gives a blue precipitate, and sulphocyanide of potassium, a red one. Chalybeate waters are divided into *carbonated* and *sulphuretted*; the former being brisk, sparkling, and acidulous, the latter containing hydrogen sulphide. To be of first quality these waters should contain considerable iron and but little of other mineral ingredients, and should be highly carbonated.

A representative spring of this type is *Schooley's Mountain* (Morris Co., N. J.), temperature 10° C. (50° F.). *Rawley Springs* (Rockingham Co., Va.), and *Cooper's Well* (Hinds Co., Miss.), are also typical. European springs of this class are represented by *Spa* (Germany), temp. 10° C. (50° F.); *Brighton* (England); *Cheltenham* (chalybeate) (England), temp. 11.1° to 11.6° C. (52° to 53° F.); *Pyrmont* (Germany), and *Schwalbach* (Germany), the latter being one of the strongest of chalybeate waters. *Anderson's Spring* (Bedford, Pa.), temp. 13.3° to 14.4° C. (56° to 58° F.), and *Ballston Spa* (N. Y.), temp. 10° to 12.2° C. (50° to 54° F.), are sometimes classed with the chalybeate springs. The *Tunbridge Wells* (England), are celebrated as iron springs.

III. Sulphur (*Sulphuretted*) Waters are impregnated with hydrogen sulphide, and other sulphides and nitrogen, in consequence of which they have an odor resembling that of rotten eggs. They react upon many metallic salts, causing black precipitates. They are frequently divided into *muriated alkaline*, and *calcic sulphur waters.* They are also divided into *cold* and *thermal sulphur springs.* Some of these waters are designated according to the color of the deposits yielded by the escaping water, as *white* (sulphur), *red* (oxide of iron, or microscopic algæ), *blue* (slate), or *yellow* (polysulphides) *sulphur waters.* This class of waters is largely represented in the United States, but not all of them are decidedly medicinal. In Europe, among the chief cold springs are: *Harrowgate Old Well* (England); *Montmorency* (France); *Nenndorf*, *Langenbrücken*, and *Meinberg* (Germany). Of the thermal springs are: *Aix-la-Chapelle* (Germany), three springs, the temperature of which ranges from 43.3° to 61.6° C. (110° to 143° F.); *Aix-les-Bains* (Savoy); *St. Sauveur*, *Baréges*, *Bagnères-de-Luchon*, and *Eaux-Chaudes* (France); and *Baden* (near Vienna). In the United States the muriated sulphur springs are represented by the *Columbia* (N. Y.); *Louisville Artesian* (thermal); *Upper* and *Lower Blue Lick*, *Big Bone Springs*, *Paroquet*, *Olympian Springs*, of Kentucky; *Massena Springs* (St. Lawrence Co., N. Y.); and *Salt Sulphur* (Monroe Co., W. Va.). The last named, together with *Sharon Springs* (White Sulphur and Magnesian Springs) (N. Y.), *French Lick* (Orange Co., Ind.), *Greenbrier White Sulphur* (Va.), contain purgative, or purgative and calcic salts. The *Red Sulphur Springs* (W. Va.) contain also a sedative organic principle termed *hydrosin* or *barégine.* *Borden Spring* (W. Va.) is sulpho-alkali-saline and purgative. *Yellow Sulphur* (Va.), and *Clifton* and *Chittenango* (N. Y.), are calcic sulphur springs. The *White*, temp. 16.6° C. (62° F.); the *Red*, temp. 12.7° C. (55° F.); and *Blue Sulphur Springs*, are noted Virginian springs. The most noted American thermal sulphur waters are those of *Calistoga* (about 60 springs), *Santa Barbara*, temp.

15.5° to 54.4° C. (60° to 130° F.), *Paso Robles*, temp. 44.4° to 50° C. (112° to 122° F.), all of California; *Middle Park* (Colo.), temp. 43.8° to 46.6° C. (111° to 116° F.); *Warm Springs* (Ga.), temp. 32.2° C. (90° F.); *Warm Springs* (Va.), temp. 35.5° to 36.6° C. (96° to 98° F.). Near Sitka, Alaska, are the celebrated *Warm Sulphur Springs* or *Geysers*, temp. 35.5° to 40° C. (96° to 104° F.).

IV. Saline Waters owe their medicinal activity to their saline ingredients, as various salts of sodium, magnesium, calcium, potassium, etc.; and the sulphates, chlorides, and carbonates are the most common. The principal constituent is sodium chloride. They usually contain small portions of iron, and often a large amount of carbonic acid, and occasionally iodine or bromine. They are divided into *Salt* (*Muriated*), *Calcic* (*Calcareous*), and *Silicious Waters.* The most agreeable of these waters are the *mild saline* or *muriated waters*, best represented in this country by the *Saratoga Springs*, temp. 9.4° to 10.5° C. (49° to 51° F.), with few exceptions (some being muriated-chalybeate, as *Hamilton*, *Columbian*, and *Pavilion Springs*), *Charleston* (S. C.), *Albany Artesian Wells* (N. Y.), and *Ballston Spa.* The *Hot Springs of Virginia*, temp. 35.5° to 41.6° C. (96° to 107° F.), are representative American alkaline-saline springs. In Europe the following are celebrated: *Selters*, *Apollinaris*, *Bath* (England), temp. 44.4° to 46.6° C. (112° to 116° F.); *Cheltenham Saline Springs* (England), temp. 11.1° to 12.2° C. (52° to 54° F.); *Carlsbad* (Bohemia), temp. 73.8° C. (165° F.); *Sprudel* and *Plombières* (France) 32.2° to 62.7° C. (90° to 145° F.). Among the calcic springs of note are: *Eaton Rapids Wells* (Mich.); *Sweet Springs* (Monroe Co., W. Va.), temp. 23.3° C. (74° F.); *Bethesda* (Waukesha, Wis.), temp. 15.5° C. (60° F.), calcic alkaline; *Yellow Springs* (Greene Co., O.), and *Gettysburg* (Adams Co., Pa.). Calcic springs are rich in limestone (calcium carbonate) and gypsum (calcium sulphate) mixed with saline and alkaline salts and some iron. Some Canadian Waters, as of the *Plantagenet* and *Caledonia*, are good examples of iodo-bromated saline waters.

Sea Water.—The proportions of the contents of sea water, as found by Schweitzer, who analyzed the water of the English Channel, are about as follows: Water, parts 29235.424+; sodium chloride 895.72+; potassium chloride 23.48+; magnesium chloride 111.12+; magnesium bromide 0.878+; magnesium sulphate 68.81; calcium sulphate 42.6+; calcium carbonate 1.0.

V. Alkaline Waters.—In these waters, sodium, potassium, and magnesium carbonates predominate, the most noted of this class being those of *Vichy* (France), temp. of the various springs ranging from 23.8° to 46.1° C. (75° to 115° F.). In Germany they are represented by such springs as *Ems*, *Fachingen*, *Salzbrunn*, etc.; in England, by *Buxton* and *Bristol; Camarés* in France; and in this country by the *Bladon Springs* of Choctaw Co., Alabama.

VI. Purgative Waters.—These waters include those having purgative or aperient properties due to the presence of sulphates of magnesium, sodium, and potassium, modified by the presence of alkaline or calcic sulphates and carbonates, or some chalybeate compound. They constitute the *Bitterwasser* (bitter water) of the Germans. Some of them are highly carbonated. European waters of this class are those of *Seidlitz* (Bohemia), temp. 15° C. (59° F.); *Friedrichshall* (in Saxe-Meiningen); *Kissingen*, *Püllna*, *Hunyadi János*, *Epsom* (England); *Ivánda* (Hungary); and *Champagne-sur-Aude* (France). American purgative waters are represented by the *Crab Orchard Springs* (Lincoln Co., Ky.); *Harrodsburg* (Mercer Co., Ky.) (containing also calcium sulphate and iron carbonate); *Estill* (*Irvine*) *Springs* (Estill Co., Ky.); and *Bedford Springs* (Bedford, Pa.), the latter being a purgative-chalybeate water.

VII. Silicious Waters.—As already remarked, these are a division of the saline waters, which are occasionally met with. The *boiling springs of Geyser*, in Iceland, belong to this division, the silica being held in solution by the sodium compounds present.

VIII. Carbonated Waters.—Formerly the carbonated waters were recognized as a separate class. They include, however, many of the waters named in the other classes. They owe their qualities to carbonic acid gas, which gives them more or less of an acidulous taste, a briskness, a sparkling property, and an acid reaction. In this class were formerly included such springs as *Seltz* or *Seltzer* (Germany); *Pyrmont* (Germany); *Spa* (Belgium); *Mont d'Or* (France), including 4 springs: *St. Marguerite's*, the temperature of which is 10° to 12.2° C. (50° to

54° F.), the *Grand Bath*, temp. 43.3° C. (110° F.), *Cæsar's Baths*, temp. 45° C. (113° F.), *La Magdelaine*, temp. 42.2° C. (108° F.); *Vichy* (France); *Sweet Springs* (Va.), etc. They are cooling, refreshing, and exhilarating, and frequently relieve nausea. They usually hold in solution ferrous carbonate, or the carbonates of one or more of the alkaline earths. Carbonated waters are contraindicated in acute diseases and in plethoric persons.

IX. THERMAL WATERS.—The indifferent thermal waters contain but small amounts of inorganic compounds, and are valuable chiefly on account of their elevated temperature, 23.8° to 71.1° C. (75° to 160° F.). The noted American springs of this type are represented by the *Hot Springs* (Ark.), numerous springs ranging in temperature from 33.8° to 65.5° C. (93° to 150° F.); *Hot Springs* (Va.), temp. 25.5° to 43.3° C. (78° to 110° F.); *Warm Springs* (Va.), temp. 36.6° C. (98° F.); *Healing Springs* (Bath Co., Va.); *Lebanon Springs* (Columbia Co., N.Y.). The *Idaho Hot Springs*, temp. 29.4° to 46.1° C. (85° to 115° F.); *Warm Springs* (N. C.), temp. 36.1° to 38.8° C. (97° to 102° F.); and *Paso Robles* (Cal.), temp. 44.4° to 50° C. (112° to 122° F.), are thermal springs not belonging to the indifferent class, but containing several active constituents. Noted European thermal waters are those of *Plombières* (France), temp. 51.6° C. (125° F.); *Gastein* (Salzburg, in Austria), temp. 30.5° to 71.1° C. (87° to 160° F.); *Teplitz* (Bohemia), temp. 48.8° C. (120° F.), etc.

Action and Medical Uses.—Mineral waters vary in their effects upon the system, according to their constituent combination. Added to their intrinsic value, when properly employed, the change of climate and habits, the hygienic influences, the abandonment of business and social cares, the pleasant associations, and various other aids, undoubtedly contribute largely to the successful treatment of chronic diseases as pursued at the various mineral springs. Injudiciously used, mineral waters are, of course, as liable to do mischief as is the injudicious employment of medicines. The uses of the various classes of mineral waters can be but briefly referred to in this article, as follows:

I. ACIDULOUS WATERS.—The acidulous waters are powerful and diffusible stimulants of the nervous and circulatory system, likewise diuretic. Generally useful in *dyspepsia*, *passive dropsy*, *chronic diseases*, *chlorosis*, and *phosphatic gravel*; contraindicated in recent palsy, apoplexy, and active hemorrhages and inflammations.

II. CHALYBEATE WATERS.—Chalybeate waters are tonic and restorative, and used in *anemia*, *chlorosis*, *dyspepsia*, all kinds of *chronic cachexiæ*, *gout*, *diabetes*, *leucorrhœa*, *chronic diarrhœa*, and chronic diseases generally, especially those attended with excessive mucous and other discharges, and those not attended with plethora, fever, or inflammation. Their use blackens the stools. They increase the appetite, and improve digestion, give increased cardiac action, and improve the quality of the blood, particularly in anemic individuals.

III. SULPHUR WATERS.—Sulphurous waters are stimulant, diaphoretic, diuretic, and emmenagogue, and are found beneficial in *chlorosis*, *gout*, *rheumatism*, *dysmenorrhœa*, *secondary syphilis*, *chronic cutaneous diseases*, *hemorrhoids*, and *deranged conditions of the stomach* and *liver*. They are contraindicated in plethora, determination to the head, and active hemorrhages and inflammations. Waters which contain iodine or bromine, have been found of some use in *goitre* and *scrofula*. For *rheumatic*, *gouty*, and *syphilitic* individuals, the thermal sulphur waters are most effective, while for *pulmonary* and other forms of *catarrhal diseases*, the cold sulphur waters are preferable. These waters are especially adapted to chronic metallic poisoning, as *lead poisoning*, and *mercurial cachexia*.

IV. SALINE WATERS.—Saline waters are diuretic and aperient, particularly useful in *chronic constipation*, *dyspepsia*, with *hepatic sluggishness*, *jaundice*, *biliary catarrh*, *gall-stones*, *urinary calculi*, *rheumatism* (when alkalies are indicated), and *gout*, especially if anemic, and in *uterine* and *renal irritability*, and *passive congestion* of these parts. *Abdominal plethora* in the robust, is benefited by these waters. Saline baths have benefited *hemiplegia* and *paraplegia* in the early stages.

CALCIC WATERS are valuable in *chronic cystitis*, with irritability, *urinary calculi*, *diabetes mellitus*, and painful forms of *dyspepsia*.

SEA WATER.—Sea water internally is an emetic and purgative; as a bath it has all the effects of an ordinary cold bath, with the addition of exerting a more stimulant action on the skin than fresh water, owing to its saline contents. It has been found serviceable in *rickets*, *enlargement of glands* or *joints*, some *chronic cutaneous eruptions*, *scrofula*, and many *chronic diseases*.

V. Alkaline Waters.—Alkaline waters are antacid, antilithic, and diuretic. They may be used for the same conditions as the saline waters, being particularly useful in *gout*, *uric acid gravel*, *urinary* and *hepatic calculi*, certain *skin diseases*, *chronic gastritis*, and *saccharine diabetes*.

VI. Purgative Waters.—Purgative waters also possess diuretic properties, and are useful in small doses in all cases where laxatives, and, in larger doses, purgation are required. They are particularly of value in *corpulency*, *hepatic engorgement*, *constipation*, and *abdominal plethora*, especially when due to intemperance in eating and drinking.

VII. Silicious Waters.—Silicious waters are of value chiefly in *chronic affections of the osseous* and *ligamentous structures*.

VIII. Thermal Waters.—Thermal waters are chiefly curative by virtue of their uniform heat, and valued mostly as aids to medicines in the treatment of various chronic disorders by means of baths. They are largely resorted to for the cure of skin affections, such as *lichen*, *psoriasis*, various *ulcerations*, *old wounds*, *enervated conditions*, *hysteria*, *acute* and *chronic articular* and *muscular rheumatism*, *gout*, *false ankylosis*, *paraplegia*, *gastralgia*, etc. They are largely resorted to as an aid in curing *syphilis*.

Artificial Mineral Water Preparations.—Sal Carolinum Factitium (N. F.) *Artificial Carlsbad salt. Formulary number*, 336: "I. *In a dry, amorphous form* (*Ger. Pharm.*).—Potassium sulphate twenty grammes (20 Gm.) [309 grs.]; sodium chloride one hundred and eighty grammes (180 Gm.) [6 ozs. av., 153 grs.]; sodium bicarbonate three hundred and sixty grammes (360 Gm.) [12 ozs. av., 306 grs.]; sodium sulphate (dried) four hundred and forty grammes (440 Gm.) [15 ozs. av., 228 grs.]. Triturate the ingredients, previously well dried, to a fine, uniform powder.

"*Note.*—The dried sodium sulphate is prepared by slowly drying the crystalline salt until it has lost one-half of its weight.

"II. *In a crystalline form.*—Potassium sulphate twenty grammes (20 Gm.) [309 grs.]; sodium chloride one hundred and eighty grammes (180 Gm.) [6 ozs. av., 153 grs.]; sodium carbonate (in clear crystals) six hundred and ten grammes (610 Gm.) [1 lb. av., 5 ozs., 226 grs.]; sodium sulphate (crystallized) eight hundred and eighty grammes (880 Gm.) [1 lb. av., 15 oz., 18 grs.]; distilled water five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]. Dissolve the potassium sulphate and sodium chloride in the distilled water, and add this solution to the other two salts, previously melted in a tared capsule and at a gentle heat in their own water of crystallization. Evaporate the mixture to about 1800 Gm. [3 lbs. av., 15 ozs., 217 grs.], set it aside in a cool place, and stir frequently, so as to prevent the formation of large crystals, taking care, however, that none of the salt separate in a pulverulent form. Distribute any remaining water of crystallization uniformly over the crystals, and dry the whole mixture sufficiently by exposure to air, so that it will retain its crystalline character. A solution of about 16 grains of the dry, or about 27 grains of the crystalline salt, in 6 fluid ounces of water, represents an equal volume of Carlsbad water (*Sprudel*) in its essential constituents.

"*Note.*—The salts employed in the preparation of the crystalline form must have been purified by recrystallization" (*Nat. Form.*).

Pulvis Salis Carolini Factitii Effervescens (N. F.). *Effervescent powder of artificial Carlsbad salt. Formulary number*, 331: "*Effervescent artificial Carlsbad salt.*—Artificial Carlsbad salt (F. 336), (in form of dry powder) one hundred and eighty grammes (180 Gm.) [6 ozs. av., 153 grs.]; saccharated sodium bicarbonate (F. 341) four hundred and ten grammes (410 Gm.) [14 ozs. av., 202 grs.]; saccharated tartaric acid (F. 8) four hundred and ten grammes (410 Gm.) [14 ozs. av., 202 grs.]. Mix the ingredients, previously well dried, and triturate them until a uniform powder is obtained. To make *Granular effervescent artificial Carlsbad salt*, substitute saccharated citric acid (F. 5), (not dried) two hundred and five grammes (205 Gm.) [7 ozs. av., 101 grs.) for an equal weight of the saccharated tartaric acid, and prepare the granulated compound as directed under the general formula (F. 319, B.). A solution of about 87 grains of this preparation, in 6 fluid ounces of water, represents an equal volume of Carlsbad water (*Sprudel*), in its essential constituents" (*Nat. Form.*).

Sal Kissingense Factitium (N. F.). *Artificial Kissingen salt. Formulary number*, 337: "Potassium chloride seventeen grammes (17 Gm.) [262 grs.]; sodium chloride three hundred and fifty-seven grammes (357 Gm.) [12 ozs. av., 259 grs.]; magnesium sulphate (anhydrous) fifty-nine grammes (59 Gm.) [2 ozs. av., 36 grs.]; sodium bicarbonate one hundred and seven grammes (107 Gm.) [3 ozs. av., 338 grs.]. Triturate the ingredients, previously well dried, to a fine, uniform powder. A solution of about 24 grains of this preparation, in 6 fluid ounces of water, represents an equal volume of Kissingen water (*Rakoczi spring*) in its essential constituents" (*Nat. Form.*).

Pulvis Salis Kissingensis Factitii Effervescens (N. F.). *Effervescent powder of artificial Kissingen salt. Formulary number*, 332: "*Effervescent artificial Kissingen salt.*—Artificial Kissingen salt (F. 337) two hundred and eighty grammes (280 Gm.) [9 ozs. av., 384 grs.]; saccharated sodium bicarbonate (F. 341) three hundred and sixty grammes (360 Gm.) [12 ozs. av., 306 grs.]; saccharated tartaric acid (F. 8) three hundred and sixty grammes (360 Gm.) [12 ozs. av., 306 grs.]. Mix the ingredients, *previously well dried*, and triturate them until a uniform powder is obtained. To make *Granular effervescent artificial Kissingen salt*, substitute saccharated citric acid (F. 5), (*not dried*) one hundred and eighty grammes (180 Gm.) [6 ozs. av., 153 grs.], for an equal weight of the saccharated tartaric acid, and prepare the granulated compound as directed under the general formula (F. 319, B.). A solution of about 80 grains of this preparation, in 6 fluid ounces of water, represents an equal volume of Kissingen water (*Rakoczi spring*) in its essential constituents" (*Nat. Form.*).

Sal Vichyanum Factitium (N. F.). *Artificial Vichy salt. Formulary number*, 338: "Sodium bicarbonate eight hundred and forty-six grammes (846 Gm.) [1 lb. av., 13 ozs., 366 grs.]; potassium carbonate thirty-eight and one-half grammes (38.5 Gm.) [1 oz. av., 157 grs.]; magnesium sulphate (anhydrous) thirty-eight and one-half grammes (38.5 Gm.) [1 oz. av., 157 grs.]; sodium chloride seventy-seven grammes (77 Gm.) [2 ozs. av., 313 grs.]. Triturate the ingredients, previously well dried, to a fine, uniform powder. A solution of about 14 grains of this preparation, in 6 fluid ounces of water, represents an equal volume of Vichy water (*Grande Grille spring*) in its essential constituents" (*Nat. Form.*).

Pulvis Salis Vichyani Factitii Effervescens (N. F.). *Effervescent powder of artificial Vichy salt. Formulary number*, 333: "*Effervescent artificial Vichy salt.*—Artificial Vichy salt (F. 338) two hundred and forty grammes (240 Gm.) [8 ozs. av., 204 grs.]; saccharated sodium bicarbonate (F. 341) three hundred and eighty grammes (380 Gm.) [13 ozs. av., 134 grs.]; saccharated tartaric acid (F. 8) three hundred and eighty grammes (380 Gm.) [13 ozs. av., 178 grs.]. Mix the ingredients, *previously well dried*, and triturate them until a uniform powder is obtained. To make *Granular effervescent artificial Vichy salt*, substitute saccharated citric acid (F. 5), (*not dried*) one hundred and ninety grammes (190 Gm.) [6 ozs. av., 307 grs.], for an equal weight of the saccharated tartaric acid, and prepare the granulated compound as directed under the general formula (F. 319, B.). A solution of about 57 grains of this preparation, in 6 fluid ounces of water, represents an equal volume of Vichy water (*Grande Grille spring*) in its essential constituents" (*Nat. Form.*).

Pulvis Salis Vichyani Factitii Effervescens cum Lithio (N. F.). *Effervescent powder of artificial Vichy salt with lithium. Formulary number*, 334: "*Effervescent artificial Vichy salt with lithium.*—Artificial Vichy salt (F. 338) one hundred and fifty-six grammes (156 Gm.) [5 ozs. av., 220 grs.]; lithium citrate (in very fine powder) fifty-six grammes (56 Gm.) [1 oz. av., 427 grs.]; saccharated sodium bicarbonate (F. 341) three hundred and ninety-four grammes [394 Gm.) [13 ozs. av., 393 grs.]; saccharated tartaric acid (F. 8) three hundred and ninety-four grammes (394 Gm.) [13 ozs. av., 393 grs.]. Mix the ingredients, *previously well dried*, and triturate them until a uniform powder is obtained. To make *Granular effervescent artificial Vichy salt with lithium*, substitute saccharated citric acid (F. 5), (*not dried*) one hundred and ninety-two grammes (192 Gm.) [6 ozs. av., 338 grs.] for an equal weight of the saccharated tartaric acid, and prepare the granulated compound as directed under the general formula (F. 319, B.). 90 grains (or about a heaped teaspoonful) of this preparation represent 14 grains of artificial Vichy salt and 5 grains of lithium citrate" (*Nat. Form.*).

AQUA PICIS LIQUIDÆ.—TAR WATER.

Preparation.—Take of tar, 2 pints; boiling water, 1 gallon. Mix together and stir with a wooden rod for 15 minutes. When cold, and the tar has subsided, strain the liquor and keep it in well-stoppered bottles (*Dub.*). The *German Pharmacopœia* prepares it by mixing with previously washed and dried pumice stone (3 parts), tar (1 part). Of this mixture add 2 parts to 5 parts of water, shake well for 5 minutes and filter. It forms a clear yellow or yellow-brown fluid.

Description, Medical Uses, and Dosage.—Tar water has a Madeira-wine color, and a sharp, empyreumatic taste; it reddens litmus, but does not effervesce with carbonate of potassium, though it becomes more darkly colored. Persulphate of iron blackens it. It consists of water, holding in solution acetic acid, resin, and pyrogenous oil. Tar water exerts a mild influence on mucous membranes, and hence has been found useful in *chronic catarrhal* and *urinary affections*, in doses of 1 or 2 pints daily. Sometimes tar water is prepared, with the addition of honey, for *pulmonary affections*. Externally, it has been found useful as a wash in *diseases of the scalp*, and other *chronic affections of the skin*. The usual dose is from ½ to 1 fluid ounce.

AQUA PIMENTÆ.—PIMENTO WATER.

Preparation.—Take of pimento, bruised, 14 ounces; water, 2 gallons. Mix them, and distill 1 gallon—(*Br.*). Or it may be prepared in the same manner as cinnamon water, on page 247, using oil of pimento instead of oil of cinnamon. A brownish resin separates on standing.

Action, Medical Uses, and Dosage.—Used in *flatulency* and *weak digestion*, in doses of 1 or 2 fluid ounces.

AQUA ROSÆ (U. S. P.)—ROSE WATER.

SYNONYM: *Aqua rosarum.*

Preparation.—"Stronger rose water, distilled water, of each 1 volume. Mix them immediately before use"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Rose water forms an agreeable, cooling, unirritating, and slightly astringent collyrium, which is useful in many *affections of the eye;* it is also added to lotions, washes, etc., to impart an agreeable perfume. It enters into the official *Unguentum Aquæ Rosæ.*

AQUA ROSÆ FORTIOR (U. S. P.)—STRONGER ROSE WATER.

SYNONYMS: *Aqua rosæ* (*Pharm.*, 1880), *Triple rose water.*

Source and Tests.—Water saturated with the volatile oil of rose petals, obtained as a by-product in the distillation of oil of rose. Stronger rose water should be kept in well-stoppered bottles, in a dark place. Stronger rose water should be colorless and clear, not mucilaginous, and give no reaction with hydrogen sulphide or ammonium sulphide T.S. (absence of metallic impurities).

Use.—Used in the preparation of *Rose Water.*

AQUA SAMBUCI.—ELDER-FLOWER WATER.

Preparation.—To fresh elder flowers, 12 pounds, add water, 2 gallons. Distill 1 gallon. The *Br. Pharm.* directs 10 pounds of the fresh flowers freed from the stalks (or an equal weight of flowers preserved, while still fresh, with salt), to 5 gallons of water, to produce 1 gallon (Imp.) of elder-flower water.

Action, Medical Uses, and Dosage.—But little oil is contained in elder flowers; the water distilled from them is sometimes used in collyria and other lotions. It is more extensively employed in England than in America. According to Mr. Haselden, the water distilled from elder flowers is better, when the flowers have been previously mixed or beaten with half their weight of chloride of sodium, as it tends to preserve them much longer from decomposition. The dose (usually as an excipient) is from 1 to 2 fluid ounces.

AQUA SEDATIVA (N. F.)—SEDATIVE WATER.

SYNONYMS: *Lotio ammoniacalis camphorata* (Codex), *Eau sédative de Raspail. Formulary number*, 11.

Preparation.—"Water of ammonia (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; spirit of camphor (*U. S. P.*), twelve cubic centimeters (12 Cc.) [195 ♏]; sodium chloride, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the sodium chloride in about five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water, add the water of ammonia and spirit of camphor, and finally enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Shake the liquid when it is to be dispensed"—(*Nat. Form.*).

Raspail's *Eau Sédative* was formerly made as follows; three strengths being indicated:

	No. 1.	No. 2.	No. 3.
Take of solution of ammonia (22°)	60 parts.	80 parts.	100 parts.
Tincture of camphor	10 "	10 "	10 "
Common salt	60 "	60 "	60 "
Water	1000 "	1000 "	1000 "

Dissolve the common salt in the water, then mix the camphor and ammonia together, and add them to the saline solution.

Action, Medical Uses, and Dosage.—Stimulant, sedative, and anodyne. It is employed in *hemicrania*, *cerebral congestion*, and *rheumatic affections*, and is applied by compresses to the affected part; and when near the eyes, care should be taken to protect them. No. 1 is for persons whose skins are easily irritated; No. 2 for allaying the pain from the *stings of insects;* and No. 3 for persons having a hard and callous skin.

ARALIA HISPIDA.—DWARF ELDER.

The bark of the root of the *Aralia hispida*, Linné.

Nat. Ord.—Araliaceæ.

COMMON NAMES: *Dwarf elder*, *Wild elder*, *Bristle-stem sarsaparilla*.

Botanical Source.—Aralia hispida is a perennial plant, with a low stem, from 1 to 2 feet high, the lower part woody and shrubby, thickly beset with sharp stiff bristles, the upper part herbaceous and branching. The leaves are bipinnate, and composed of oblong-ovate, acute, cut-serrate leaflets. The flowers, which are greenish-white, are arranged in numerous umbels which are simple, globose, axillary, and terminal, on long peduncles, and followed by bunches of dark-colored, nauseous berries. It flowers from June to September. The whole plant exhales an unpleasant odor.

History.—This is a low undershrub, growing from New England to Virginia, in fields, hedges, rocky places, and along the road-sides. The fruit is round, black, one-celled, containing three irregular-shaped seeds. The bark of the plant is employed in medicine, but that of the root is the most active. It yields its virtues to water.

Action, Medical Uses, and Dosage.—The leaves in warm infusion are sudorific. It has a marked influence upon the secretions, and the circulation. The bark is diuretic and alterative, and has an especial action on the kidneys, increasing secretion and allaying irritation. Very valuable in *dropsy*, *gravel*, and *suppression of urine*, and other urinary disorders. The juice and decoction of the fresh roots are said to be emetic and hydragogue, and have been found efficient in *dropsy*. Dose of decoction (℥ss to aqua Oj), 2 to 4 ounces, 3 times a day. Specific aralia hispida, 1 to 30 drops.

Specific Indications and Uses.—Diffused anasarca; dropsy of cavities; œdema; dropsy with constipation; renal and hepatic torpor; dyspnœa; and pain in the lumbar region.

ARALIA NUDICAULIS.—FALSE SARSAPARILLA.

The root of the *Aralia nudicaulis*, Linné.

Nat. Ord.—Araliaceæ.

COMMON NAMES: *American*, *Wild*, or *False sarsaparilla*, *Small spikenard*, *Wild licorice*, *Shot bush*.

Botanical Source.—Aralia nudicaulis is a smooth, herbaceous, perennial plant, with a large, fleshy, horizontal, creeping, tortuous root, very long, often many feet in length, about 6 lines in diameter, and yellowish or brownish externally; from this arises a solitary, large, compound, radical leaf, the leaflets of which are oval and obovate, acute, and finely serrate. A scape or flower stem also arises from the root, which is shorter than the leaf, naked, about 1 foot high, terminating in three small, simple, many-flowered, globose umbels, without involucres. The flowers are greenish, or greenish-yellow. The fruit is a small drupe or berry.

History.—This plant, sometimes known as *American*, *Wild*, or *False sarsaparilla*, is indigenous, growing in moist woodlands, in the Northern and Middle States, and as far south as Tennessee and South Carolina. The part employed is the root; when fresh it has an agreeable balsamic odor, and a pleasant, spicy, saccharine taste. It yields its virtues to water or alcohol. In commerce this plant is often substituted by spikenard.

Description and Chemical Composition.—The rhizome, when dry, is found in commerce in longitudinally-wrinkled pieces, having but few rootlets, and being a little over 1 foot long, and about ¼ inch in diameter, of a grayish-brown color externally, and marked by shallow, cotyloid scape-scars, and annulated on the upper surface. The bark of the root easily exfoliates. Internally the root is white, with a starchy, sponge-like pith, enclosed by a yellowish wood. It breaks with an abrupt fracture, and has a somewhat balsamic odor, and a mawkish, somewhat oily, unpleasant taste. It contains starch, pectin, sugar, resin, and a trace of a volatile oil. For an interesting paper on this drug, see contribution of William Alpers to the American Pharmaceutical Association, 1897.

Action, Medical Uses, and Dosage.—Small spikenard possesses alterative properties, and is used in decoction or syrup as a substitute for sarsaparilla in all cases where an alterative is required. It is likewise used in *pulmonary diseases*. Externally, a decoction of it has been found beneficial as a wash in *zona* (shingles) and in *indolent ulcers*.

ARALIA RACEMOSA.—SPIKENARD.

The root of *Aralia racemosa*, Linné.

Nat. Ord.—Araliaceæ.

Common Names: *American spikenard*, *Spignet*, *Pettymorrel*.

Botanical Source.—Spignet is an indigenous perennial, having an herbaceous, widely branched, smooth stem, 3 or 4 feet in height, of a dark-green or reddish color, arising from a thick, fleshy, aromatic root. The leaves are decompound; the leaf-stalks dividing into three partitions, each of which bears 3 or 5 large, ovate, pointed, serrate, slightly downy leaflets. The umbels are numerous, small, arranged in branching racemes from the axils of leaves or branches, and are composed of small greenish-white flowers, succeeded by dark-purple berries.

History.—This plant grows from Canada to Georgia, and westward throughout the United States. It flowers in July, and is found in rich woodlands, and rocky situations, often growing in the crevices of rocky declivities.

Description and Chemical Composition.—The rhizome is from 4 to 8 inches long, and several inches in thickness, growing obliquely, and having a light-brown color externally, being whitish within. It is prominently marked by scars or cavities, an inch or more in width, where stems of the previous year were attached. The older stem-scars are deepest. The rootlets are long, often attaining a length of 2 or 3 feet, and being about 1 inch in thickness at the base. Their color is like that of the rhizome, the central portion being reddish. They are sparingly branched, and somewhat wrinkled. They break easily, with an irregular, transverse fracture. The taste is pleasantly spicy and balsamic, and the odor of the root peculiar and agreeably aromatic. The whole plant, when bruised, gives off this balsamic aroma. Its constituents are those of the *A. nudicaulis*.

Action, Medical Uses, and Dosage.—The root of Aralia racemosa possesses properties similar to that of the *A. nudicaulis;* it was formerly much used in *pulmonary affections*, and enters into the compound syrup of spikenard. Dose: specific aralia racemosa, 5 to 30 drops in water, 4 times a day; infusion (℥ss to aqua Oj), ½ to 2 fluid ounces.

Specific Indications and Uses.—Atonic states, with cough and irritation of the broncho-pulmonary tract; catarrhal affections.

Related Species.—*Aralia californica, California spikenard.* Resembles *A. racemosa* in properties and appearance, though both the root and plant are larger.

ARALIA SPINOSA.—PRICKLY ELDER.

The bark of the *Aralia spinosa*, Linné.

Nat. Ord.—Araliaceæ.

Common Names: *Prickly elder*, *Angelica tree*, *Hercules' club*, *Toothache bush* or *tree*, *Southern prickly ash* (improperly so-called).

Botanical Source.—The Aralia spinosa is a small tree, with an unsymmetric, naked stem, about 10 or 12, sometimes 20, feet high, but taller in warm latitudes, having prickles below, and the leaves all crowded near the summit. The leaves are very large and long, often 3 to 6 feet in length, prickly, bipinnate, and borne on long, prickly petioles. The leaflets are ovate, acuminate, serrate, sessile, and glaucous beneath. The flowers are white, and disposed in numerous umbels, forming a very large panicle. The involucres are small and few-leaved. The fruit consists of blackish, juicy berries.

History.—The prickly elder inhabits the United States in various parts, from Pennsylvania to Louisiana, and westward to Missouri, growing in damp and rich woods and fields. The thin, ash-colored bark is the part used, although other parts of the plant possess medicinal properties; it has a peculiar, somewhat fragrant odor, and a slightly bitter, biting taste; alcohol or water extracts its properties. It is frequently grown in the Northern States for ornamentation. It blooms in August and September.

Description.—Aralia bark, as it occurs in drug houses, is curved, or in thin quilled pieces, with an external gray, smooth surface, or slightly marked with linear elevations, and the stem-bark usually with transverse lines of slender prickles, or in the absence of these, short ridges running crosswise. Beneath the corky layer, the color is brownish-green or green. The inner bark is composed of layers concentrically disposed, and breaks with a smooth, but tough fracture. The taste is sharp, acrid, and bitter; the odor slightly balsamic.

Chemical Composition.—The chemical investigations of this bark by different authors present somewhat conflicting results. L. H. Holden (*Amer. Jour. Pharm.*, 1880) found in it fat, tannin, a slightly acrid resin, and a yellowish glucoside to which he gave the name *araliïn*. It is soluble in alcohol and water, and froths considerably in aqueous solution upon shaking. Araliïn, when acted upon in aqueous solution by hydrochloric acid, splits into sugar and a white, insoluble, tasteless body, called *araliretin* by Holden. Elkins (*Amer. Jour. Pharm.*, 1880) demonstrated the presence of the following organic constituents: starch, glucose, pectin, gum, two acrid resins, a volatile oil, and an alkaloid. The latter constituent, however, J. K. Lilly failed to obtain (*Amer. Jour. Pharm.*, 1882). Lilly isolated the volatile oil by distillation; also the bitter, amorphous, extract-like principle, the resinous, acrid principle, and obtained Holden's araliïn in pure form, characterized by its striking saponaceous property. Satisfactory tests for tannin were not obtained by Lilly.

Action, Medical Uses, and Dosage.—The fresh bark will produce vomiting and purging; but when dried it is a stimulating alterative, producing a determination toward the surface. The tincture has been used in *syphilitic* and *rheumatic affections*, and in some *diseases of the skin*. The warm infusion, especially when strong, is apt to induce vomiting. The berries in tincture have been found useful in lulling the *pain from a decayed tooth;* also in various *painful affections* of other parts. Much use was made of this bark by physicians in Cincinnati during the *cholera* of 1849–50, in cases where cathartics were required, but where the action of every purgative was difficult to control; the preparation was composed of 1 drachm of compound powder of jalap, 1 drachm of aralia spinosa, and 2 drachms of compound powder of rhubarb. Given in powder, in half-teaspoonful doses; or the powder was infused in half a pint of boiling water, of which infusion, when cold, a tablespoonful was given every half hour. In no case in which it was given did it produce a tendency to looseness or choleraic discharges. It is a powerful sialagogue, and is valuable in diseases where the mouth and throat are dry and parched, as a very small portion of the powder will produce a moisture and relieve difficult breathing; also useful in *sore throat*. The dose of tincture (bark ℥viij to dilute alcohol Oj) is from 5 to 60 drops; of the infusion (℥ss to aqua Oj) a tablespoonful to a wineglassful.

Related Species.—*Aralia edulis*, Siebold. In Japan it is universally cultivated in fields and gardens, where it attains a height of 3 or 4 feet, flowering in August, and ripening its bluish-black berries in November. It is valued chiefly on account of its root, in Chinese trade called Tang-Kwei, which is eaten like scorzonera, but the young stalks are likewise a delicious vegetable. The root is fleshy, resembling gentian, and has a sweetish, aromatic taste, and an odor approaching that of celery or angelica. It is said to be brought from Western China (Hanbury, *Science Papers*).

Aralia papyrifera, Hooker. (Properly *Fatsia papyrifera*, Decaisne and Planchon.) Native of Formosa. The so-called *Rice paper tree* of the Chinese. The pith of the stem (1 to 1½ inches in diameter) is unrolled by cutting with a sharp knife from circumference to the center, flattened and pressed in small sheets known as *Rice Paper*, and used in ornamental fancy-work, especially to imitate delicate petals in making artificial flowers. For description and illustration see *Am. Jour. Pharm.*, 1879, p. 241.

ARANEA DIADEMA.—DIADEM SPIDER.

The freshly spun web, free from dust, of the *Aranea diadema*, Linné (*Epeira diadema*). *Class*: Arachnida; *Order*: Araneidea; *Family:* Epeiridæ.

Common Names: *Web of diadem spider*, *Papal cross spider*, *Garden spider*, *Cross spider*.

History, Description, and Preparation.—The diadem spider inhabits old walls, stables, etc., throughout America and Europe. It may be known by its large ovoid body, often attaining the size of a small nut. Along the back is a longitudinal line composed of white and yellow points, while three other lines of like appearance traverse the body. This remedy is of homœopathic origin, and followers of that faith prepare a tincture by crushing the live insect and covering it with 5 parts of alcohol. The web only has been employed by Eclectic practitioners. The tincture may be prepared by macerating 2 ounces of the fresh, clean web in 1 pint of 98 per cent alcohol, allowing it to macerate 10 days, then filter.

Action, Medical Uses, and Dosage.—This remedy is but little used by our practitioners. "It has been employed in *ague* and *malarial disease* when there was marked confusion of intellect, with headache and burning of the face and eyes. In ague the chill is prolonged, with great pain in the bones, and a feeling as if bruised" (Scudder, *Spec. Med.*, 77). Dose of tincture, prepared as above directed, fraction of a drop to 10 drops (see *Tela Araneæ*).

Specific Indications and Uses.—Chills with confusion of ideas; chills prolonged, with prostration, febrile reaction not high (Scudder, *List of Spec. Ind.*).

ARAROBA.—GOA POWDER.

A powder obtained from cavities in the trunk of the *Andira araroba*, Aguiar. *Nat. Ord.*—Leguminoseæ.

Common Names: *Goa powder*, *Bahia powder*, *Brazil powder*, *Ringworm powder*, *Chrysarobine*, *Chrysarobin* (improperly so-called).

Botanical Source, History, and Description.—This drug must not be confused with *Arariba rubra*, a Brazilian plant, the bark of which was investigated by Rieth, in 1861, and has been used as a red dye for wool in its native country. Dr. Fayrer was the first to call attention to Goa powder in the *Med. Times and Gaz.*, Oct., 1875, but was unable to give its origin, farther than that it reached Bombay through Goa on the Malabar coast, thus acquiring the name *Goa powder*, by which it is commonly known. Its source was kept secret for some time, and the powder was sold at exorbitant prices. In the same year (1875) E. M. Holmes called attention to the identity of araroba with goa powder, suggesting that it was probably produced by a species of *Cæsalpinia*, and for some time his conclusion was generally accepted although not without reserve. Dr. J. M. de Aguiar, of Bahia (1879), published an article in pamphlet form upon this subject (*Pharm. Jour. and Trans.*, July, 1879; also *New Remedies*, Sept., 1879) which lightened the mystery that had heretofore surrounded its source. He informs us that *araroba* is derived from a large intertropical tree, the ordinary height of which is 80 or 100 feet. It belongs to the Leguminoseæ, and tribe of Dalbergieæ, resembling, in some respects, *Dalbergia miscolobium*, Bentham, and *Andira fraxifolia*, Bentham. After having given a careful botanical description, the author concludes that the tree has been heretofore undescribed, and proposes for it, the name *Andira araroba*, Aguiar, "since the drupaceous fruit, panicled infloresence, purple flowers, and other characters, clearly point to its being an *Andira*."

The araroba powder is obtained by cutting down the older trees, as they yield it in the greatest abundance, and then scraping the powder from cavities found by splitting the trunk into longitudinal sections. The tree contains an abundance of resin, by the oxidation of which, Dr. de Aguiar believes, the araroba is produced. When fresh, it is a pale primrose color, but, by age, changes to the color of rhubarb, and, eventually, becomes dark-purple. The tree exists abundantly in all the southern part of the province of Bahia, although the powder now chiefly comes from Camamu and Taperoa. As found in commerce, this agent is in the form of a powder of different degrees of fineness, of a color ranging from light-yellow to dark-chocolate. It resembles the partly decayed matter occasionally observed in cavities of old trees and stumps, and is often mixed with irregular woody fragments. It is now fairly established that it is the partly decayed matter of the *South American* tree above mentioned, and thus, curiously enough, by the way of distant India, where it had been long used, this product of the South American forest was introduced to the medical profession.

Chemical Composition.—Araroba is remarkable for occasionally yielding from 80 to 85 per cent of chrysophanic acid, as shown by Attfield, in 1875, and, according to the same authority, the remainder of the powder examined consists of 7 per cent of a glucoside and bitter matter, 2 of a resinous substance, 5½ of a red woody fiber, and ½ per cent of ash. The ashes consist chiefly of silicate of aluminum, and sulphates of potassium and of sodium. Prof. J. U. Lloyd examined several specimens upon the market, and, in all cases, obtained a much smaller proportion of chrysophanic acid than stated by Mr. Attfield. Therefore, he concluded that Attfield must have procured an unexceptionally rich specimen of araroba, or that which reached this country was very inferior. Araroba readily yields chrysophanic acid to benzin. When heated in a suitable vessel, a sublimate is obtained, which, doubtless, consists largely of the aforementioned acid, as it is colored red by alkalies in solution. Araroba is chiefly employed for the preparation of chrysophanic acid (which see). Liebermann and Siedler, are authority for the statement that chrysophanic acid does not exist ready-formed in araroba, but is formed by oxidation of a natural constituent, to which they give the formula $C_{30}H_{26}O_7$, and the name *Chrysarobin* (previously applied to araroba).

Action, Medical Uses, and Dosage.—In the Indies this agent has been employed for the removal of *tænia solium*, and in the treatment of certain *cutaneous maladies.* Attfield, Fayrer, Da Silva Lima, Squire, Hebra, Bernier, Blanc, Thin, and many other medical men have successfully employed this powder in the treatment of *herpes circinatus*, *porrigo scutulata*, *porrigo decalvans*, *sycosis*, *favus*, *psoriasis*, *eczema*, *lichen*, *acne*, and other *diseases of the skin.* The powder is mixed with vinegar or lemon juice to form a thin, pasty mass, or is well incorporated with glycerin or starch paste, and then applied over the eruption once or twice a day, for from 5 to 8 days successively, in which period of time the cure is generally affected. Its application causes, after some length of time, a temporary uneasy sensation in the part to which it is applied, the eruption assumes a whitish appearance, and the surrounding tegument presents the appearance as of a dark stain; as the cure progresses, the skin assumes its normal color. For internal use, it may be taken in the form of pills, made by incorporating it with medicinal soap. For external application, it may be used as above stated, by means of a small brush, or a tincture of the powder may be painted upon the affected parts. It may be also used in the form of an ointment, consisting of from 15 to 60 grains of the powder, from 15 to 30 drops of acetic acid, all thoroughly mixed with an ounce of benzoinated lard. At the present time, however, chrysophanic acid and chiefly chrysarobin (which see) are used in preference to the goa powder.

ARCHANGELICA ATROPURPUREA.—PURPLE ANGELICA.

The root, herb, and seed of the *Archangelica atropurpurea*, Hoffman (*Angelica atropurpurea*, Linné, *Angelica triquinata*, Michaux).

Nat. Ord.—Umbelliferæ.

Common Names: *Purple angelica*, *Masterwort*, *High angelica*, *Great angelica*

Botanical Source.—The Angelica atropurpurea has a root of a purple color, and a smooth, dark-purple, furrowed, hollow, glaucous stem, 5 or 6 feet high, and 1 or 2 inches in diameter. The leaves are ternately divided and the large petioles much inflated, channeled on the upper side; the leaflets are pinnate, 5 to 7 in number, sharply cut-serrate, acute, pale beneath, the terminal one sometimes 3-lobed, the lateral one of the upper division decurrent. The pale, greenish-white flowers are borne in three large, terminal, many-rayed, spreading, spherical umbels, 6 to 8 inches in diameter, without the involucre. The umbellets are dense, subhemispheric, on angular stalks, and with involucels of subulate bracts longer than the rays. The calyx 5-toothed; the petals equal, entire, with the point inflected. The involucels are short, about 8-leaved. The fruit is smooth, compressed, elliptic, somewhat solid and corticate.

Description.—The root is about ¾ inch in diameter, and 3 to 6 inches in length. It is branched, of a pale, brownish-gray color on the external surface, which is deeply furrowed. Internally it is nearly white. It breaks with a short fracture, showing a thick bark finely dotted with resinous deposits, enclosing a soft wood. It has a fragrant odor, and is spicy and sweet to the taste, afterward bitter. It is extremely liable to the attack of insects.

History and Chemical Composition.—This perennial plant grows in fields and damp places, developing greenish-white flowers from May to August. The plant has a powerful, peculiar and not disagreeable odor, and a sweet taste, succeeded by considerable pungency and spiciness; much of these properties is lost by dessication. They are due to a volatile oil, acrid soft resin, and a volatile acid. Starch also abounds in the root. The fresh root is reputed to act as a poison.

Action, Medical Uses, and Dosage.—Aromatic, stimulant, carminative, diaphoretic, expectorant, diuretic, and emmenagogue. Used in *flatulent colic* and *heart-burn*, and *nervous headache*. The root has been candied and eaten. It is said to promote the menstrual discharge. In *diseases of the urinary organs*, *calculi* and *passive dropsy*, it is used as a diuretic, in decoction with uva ursi and Eupatoreum purpureum. Dose of the powder, 30 to 60 grains; of the decoction, 2 to 4 ounces, 3 or 4 times a day. The *Archangelica officinalis*, Hoffmann (*Angelica Archangelica*, Linnè), may be substituted for the above.

Related Species.—*Archangelica hirsuta*, Torrey and Gray (*Angelica hirsuta*, Michaux). U. S. (Southern States). Often collected with purple angelica, the root of which it resembles.

ARCHANGELICA OFFICINALIS.—GARDEN ANGELICA.

The root and seeds of the *Archangelica officinalis*, Hoffmann (*Angelica Archangelica*, Linné, *Angelica officinalis*, Moench).

Common Name: *Garden angelica.*

Botanical Source.—Garden angelica is a plant about 5 or 6 feet high. Its biennial root is fleshy, quite thick and long, and from it ascends every year a smooth, branched, fistulous, articulated and furrowed stem, of a purple color. The leaves are large, bipinnate, with acute, lance-ovate, serrate leaflets, the terminal one trilobate, and are borne on hollow foot-stalks. The greenish-white flowers are arranged in umbels which in turn are made up of compact, semiglobular umbellets.

History.—This plant is a native of Northern Europe, but is also found further south, especially in high altitudes, as among the Alps and Pyrenees. Much of it is cultivated in Germany from whence the drug market is chiefly supplied. The cultivated variety is said to differ from the native species sufficiently for some botanists to classify it as a distinct species. Thus it has been known as *Archangelica sativa*, Fries (*Angelica sativa*, Miller). The root should be gathered in the first year's autumn, as it is more likely to keep without becoming covered with mould. Its properties are in part abstracted by water, and fully by alcohol. It is highly valued as a domestic drug and condiment by the natives of Lapland where it is indigenous. The stems are preserved in Europe and employed as a food and gastric excitant. The fresh root when broken, emits an aromatic fluid having the appearance of honey. The warm infusion is an eligible form of administration.

Description.—Root. The root-stock is from 2 to 4 inches in length, and seldom exceeds 2 inches in thickness. It is fusiform, corrugated, annulated above, and tipped with the remains of leaf-stalks. It has many tuberculated rugose branches which are from 5 to 12 inches long, and ¼ inch thick. The color externally is gray-brown, and it is whitish or yellowish-white within. It has a thick bark enclosing a yellowish wood. The bark shows resin dots, indicating the position of resin ducts. The root breaks with an amylaceous fracture. Its taste is sweetish, spicy, and followed by bitterness. It has an aromatic fragrance, and is liable to attack and destruction by insects.

SEEDS.—The seeds are of an ashen color, oval, from 2 to 3 lines in length, slightly bifid at the extremities, convex with three distinct ridges on one surface, and traversed on the other by a single groove running lengthwise. Their odor is aromatic, and their taste pungent, sweetish, and bitter.

Chemical Composition.—This root contains the usual plant constituents as, albumen, lignin, tannin, pectin, starch, sugar, and salts; also malic acid (Buchner). Buchner, in 1842, obtained from the root *angelic acid* ($C_5H_8O_2$), an unsaturated volatile body, of acid taste and aromatic smell. It crystallizes in colorless prisms, fusing at 45° C. (113° F.). Buchner also abstracted a wax-like, white substance, crystallizing from alcohol in warty masses; an acid resin of acrid taste, capable of forming acicular crystals from alcoholic solution. To this substance he gave the name *angelicin*. In 1877, Brimmer proved its identity with Husemann's *carotin*, and still later, 1886, Arnaud demonstrated that in all probability it is identical with *phytosterin*, a cholesterin-like body contained in *Physostigma venenosum* (calabar bean). Buchner finally obtained from the root an amorphous, bitter principle, and a yellow, volatile oil which was subsequently investigated quite extensively. It consists, for the most part, of terpenes ($C_{10}H_{16}$) (Beilstein and Wiegand, 1882), containing, among other constituents, dextrogyrate *phellandrene* (Schimmel's *Reports*, 1891–93–96). There are also oxygen compounds present in the oil. In 1880, R. Müller isolated therefrom *oxymyristic acid* ($C_{14}H_{28}O_3$). The presence of metyl-ethyl acetic acid, an isomer of valeric acid, has also been established. In 1896, Schimmel & Co. state that the oil from the seed is abundant, and deserves the preference over that distilled from the root. The percentage of oil from the dried root is 0.35 to 1 per cent; from the fresh root 0.25 to 0.35 per cent. The specific gravity at 15° C. (59° F.) is 0.855 to 0.905 (Schimmel & Co., *Semi-Annual Reports*, Oct., 1893).

Action, Medical Uses, and Dosage.—Diuretic, stimulant, tonic, and emetic. It has been applied as a fomentation in *tumefactions* and *swellings*, and given internally in *enteric fever* and other *typhoid states*, *chronic rheumatic complaints*, *gout*, and *malarial intermittents*. As a stimulant to the respiratory mucous surfaces it has been serviceable in *chronic bronchitis*. The dose of the infusion (℥j to aqua Oj) is from ½ to 1 wineglassful; of the powdered root, 5 to 30 grains; of the powdered seeds, 5 to 30 grains.

Related Species and Preparations.—*Levisticum officinale*, Koch (*Ligusticum Levisticum*, Linné). *Nat. Ord.*—Umbelliferæ. *Lovage.* Mountains of South Europe and in gardens. The root and seeds are employed. The former is from 1 to 1½ inches thick, has several heads, is somewhat annulated, and is wrinkled lengthwise. Externally, yellow-brown; internally, light-yellowish. The thick bark is radially striated, fissured externally, and has numerous resin cells of an orange color, arranged in imperfect circles. Its odor is aromatic, resembling somewhat that of angelica. Its taste is pungent, mucilaginous, and balsamic. The seeds are ovate-oblong, or elliptical, small, compressed, curved, and strongly marked with ribs, which are winged, and in the grooves between the ribs occur one or more oil-tubes. The color of the fruit is yellowish-brown. Analysis has revealed several hard and soft resins, one of which has a pungent, bitter taste, a thick, volatile oil, containing a large amount of stearopten, sugar, and mucilage. The coloring principle is *ligulin* (Nickles) and has been proposed as a test for calcium compounds in water, the substance imparting to distilled water a permanent crimson hue, which with lime-water changes in a brief space of time to a handsome blue. Lovage is a gastric stimulant, diuretic, emmenagogue, and carminative. It closely resembles angelica in its action and uses. The infusion is the best form of administration.

Ligusticum filicinum, Watson. *Osha*, or *Colorado cough root.* Rocky Mountain regions. Root resembles the preceding in appearance and action. Used as a stimulating expectorant (see *A. J. P.*, 1890–91). A Mexican umbellifer, of unknown botanical source, known as *Osha root*, yielded *oshaic acid*, which very closely resembles angelic acid (Haupt).

Ligusticum actæifolium.—Southern States. Properties same as Lovage.

Ligusticum sinense.—The *Kao-pén* of the Chinese, who employ it medicinally.

Laserpitium latifolium, Linné. This is the *Radix gentianæ albæ* of former times, so called on account of its gentian-like appearance. It has, however, a white interior, and a brownish-white exterior. Its bark is thick and spongy, and is interspersed with resin cells of a yellow color. It contains a crystalline bitter, *laspitin* ($C_{15}H_{22}O_4$). It is reputed a prompt purgative.

Pimpinella Saxifraga, Linné. *Small burnet saxifrage.*—A European perennial umbellifer, the root of which has a pungent, biting, balsamic, sweetish and bitterish taste, and a disagreeable, strongly aromatic odor. Acrid resin, a bitter principle, *pimpinellin*, soluble in alcohol, and a golden-yellow, light, volatile oil, having a sharp taste, and a parsley-like odor, are its chief constituents. The root is reputed diuretic, diaphoretic, and stomachic. Its uses are similar to those of levisticum and angelica. *Asthma, catarrh, dropsies, amenorrhœa*, etc., and *toothache* (applied locally) have been treated with it. It was formerly much used (in Germany) to expel mercury from the system after a mercurial course. The following tincture may be employed:

TINCTURA PIMPINELLÆ (N. F.), *Tincture of Pimpinella. Formulary number*, 420.—"Pimpinella, root, one hundred and sixty-five grammes (165 Gm.) [5 ozs. av., 359 grs.]; alcohol, water, of each a sufficient quantity, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix 2 volumes of alcohol with 1 volume of water. Macerate the pimpinella, reduced to a moderately coarse (No. 40) powder, with enough of the menstruum to keep it distinctly damp during 12 hours. Then percolate it with the same menstruum, in the usual manner, until 1000 Cc. [33 fl℥, 391 ♏] of tincture are obtained.

Note.—This preparation is approximately of the same strength as that which is official in the *Germ. Pharm.* Pimpinella root is derived from *Pimpinella Saxifraga*, Linné, and *Pimpinella magna*, Linné—(*Nat. Form.*).

Pimpinella magna, Linné, is also known as *Small burnet saxifrage*, and is similar to the foregoing in properties and used like it. It enters into the foregoing tincture.

ARECA.—BETEL NUT.

The seed of *Areca Catechu*, Linné.

Nat. Ord.—Palmæ.

COMMON NAMES: *Areca nut, Betel nut.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 276.

Botanical Source, History, and Description.—The tree furnishing areca nut (*Semen arecæ*) is a handsome palm, probably indigenous to the Malayan group of islands where it is cultivated. It is also cultivated in Ceylon, India, Indo-China, and the Phillipine Islands. Its straight trunk, nearly 2 feet in circumference, shoots upward to a height of 40 or 50 feet. The flowers are borne on a spadix, the male flowers above, the female flowers lowermost. The fruit is ovoid and smooth. It is about as large as a small-sized hen's egg, orange-yellow in color, and consists of a fibrous envelope adherent to a crustaceous endocarp enclosing the single seed. The seeds are hard and heavy, and are cut with difficulty. In shape they are round-conical, and depressed at the base, and at one side of the depressed portion a tuft of fibres is frequently found, showing where the seed was attached to the pericarp. Their color externally is brown, mottled with fawn color, giving it a reticulated appearance. Its internal structure closely resembles that of the common nutmeg, being a brown-red with whitish veins. The odor, when the nut is fresh, is feeble, resembling cheese. The taste is astringent and sub-acrid. Betel nuts have long been employed by the Asiatics as a masticatory, for sweetening the breath and hardening the gums, and are believed by them to improve the digestive powers. They have been given to both dogs and human beings in China and India as a vermifuge (*Pharmacographia*). They are often chewed with slaked lime and *piper betle leaves* (see *Matico, Related Species*).

Chemical Composition.—Areca nuts contain tannin, gallic acid, gum, lignin, volatile and fixed oils, iron peroxide, magnesium phosphate, and other salts. The tannin resembles catechu-tannic acid, is red, and strikes green with ferric salts, quickly changing to brown, and when an alkali is added, a violet coloration ensues. It is not very soluble in either hot or cold water. Pyrocatechin was obtained from it by dry distillation, but no catechin is present in the nut (*Pharmacographia*). Four alkaloids were isolated by Jahns (*Amer. Jour. Pharm.*, 1889, 1891) from areca nuts. *Arecoline* ($C_8H_{13}NO_2$), a colorless, volatile, and oily, nicotine-like principle, identical with Bombalon's (1885) *arekane.* The tænifuge properties of the drug are probably due to this principle. It mixes with water, chloroform, alcohol and ether. It yields crystallizable salts, among which the hydrobromide crystallizes best; some of these salts are deliquescent. *Arecaine* ($C_7H_{11}NO_2+H_2O$) probably a betaïne-like body, physiologically inert, forms permanent, colorless crystals, insoluble in ether, chloroform, and benzol, almost insoluble in absolute alcohol, but dissolving with ease in diluted alcohol and water. Its salts are crystallizable, acid, and freely dissolve in water. A third alkaloid, *arecaïdine* ($C_7H_{11}NO_2+H_2O$), an isomer of arecaine, and non-poisonous, was discovered by Jahns, in 1891. The poisonous arecoline aforementioned is methyl-arecaïdine. A fourth alkaloid, discovered by Jahns, and called *guvacine* ($C_6H_9NO_2$), is the lower homologue of arecaïdine, and non-poisonous.

Action, Medical Uses, and Dosage.—Astringent and tænicide. The chief use of this drug is to expel *tapeworms*, for which it is said to be efficient in doses of 2 to 6 drachms of the powdered nut, administered in syrup. The smaller dose is generally effectual. A hard charcoal suitable for dentifrices is prepared from the nut. Arecoline is the tænifuge principle, resembling pelletierine, both chemically and in action. Arecaine, the betaïne-like body, has been likened to trigonelline from fœnugreek. Experimentation with it upon animals proved it to be inert.

ARGEMONE.—PRICKLY POPPY.

The plant *Argemone mexicana*, Linné.

Nat. Ord.—Papaveraceæ.

COMMON NAME: *Prickly poppy.*

Botanical Source.—This annual plant has a stem about 2 feet high, erect, bristly, and glaucous. The leaves are sessile, alternate, sinuately lobed, the angles armed with prickly spines, and spotted with white patches. The flowers, which are either yellow or white, and about 1½ inches wide, are solitary, have numerous stamens and from 4 to 6 petals. The sepals, 3 in number, are deciduous and prickly. The stigmas, 4 to 6, are reflected. The capsule is ovate, prickly, about 1 inch in diameter, terminated by a radiate, subsessile stigma, and has many seeds which are minutely pitted, and blackish in color. The plant, when bruised, exudes a viscid, milk-like juice, which turns yellow when exposed to the atmosphere. The whole plant has an acrid, bitter taste.

History and Chemical Composition.—This plant is native to Mexico, the West Indies, Southern and Western United States, and has been naturalized in Brazil, Hindustan, Africa, and other subtropical and tropical places. The seeds of this plant yield a large quantity of a pale-yellow, fixed oil, of the drying variety, yet slow to dry, doing so incompletely, has a sickening odor, and is nearly bland, or but feebly acrid, and not disagreeable to the taste. This oil yielded a hard soap with soda, and gave in the soap-liquor acetic, valerianic, and butyric acids, and a trace of benzoic acid (Frölich, 1871). The oil is a mild cathartic in small doses, and has a density of 0.919 at 16.5° C. (61.8° F.) (Flückiger). From the capsules and leaves a small quantity of *morphine* was obtained by Charbonnier, in 1868. It is also believed to contain *sanguinarine*. The oil has been proposed for use in painting. The flowers have soporific properties (De Candolle).

Action, Medical Uses, and Dosage.—Emetic, purgative, anodyne, and narcotic. The juice is applied in the East to *warts*, *chancres*, *ulcers*, *corneal opacities*, and *ophthalmia*; internally, it is used in certain *skin diseases*. The juice in its acrimonious qualities resembles gamboge. The oil is useful in *flatulent colic*, with atony of the bowels and constipation; also in *headache*. From 10 to 20 drops of the oil mildly purges; larger doses act as an emetic and hydragogue cathartic. The herb in infusion is diaphoretic. It is not much used in this country.

ARGENTI CYANIDUM (U. S. P.)—SILVER CYANIDE.

FORMULA: AgCN. MOLECULAR WEIGHT: 133.64.

SYNONYM: *Argentum cyanatum.*

Preparation.—This salt may be prepared by adding an excess of pure potassium cyanide, in solution, or of hydrocyanic acid, to a solution of silver nitrate. Collect the precipitate, wash it well and dry it. The *U. S. P.* of 1870 directed its preparation as follows: Dissolve silver nitrate, 2 troy ounces, in distilled water, 1 pint, and pour it into a glass receiver (tubulated). Dissolve potassium ferrocyanide, 2 troy ounces, in distilled water, 10 fluid ounces; put into a tubulated retort, which has been first connected with the above-mentioned glass-receiver, then mix with distilled water, 4 fluid ounces, sulphuric acid, 1½ troy ounces, and pour the mixture into the solution of potassium ferrocyanide, and with moderate heat distill on a sand-bath 6 fluid ounces, or until a precipitate is no longer thrown down in the receiver. Wash the precipitate, and dry the salt.

Description.—"A white powder, without odor or taste, permanent in dry air, but gradually turning brown on exposure to light. Insoluble in water, alcohol, or cold nitric acid, but soluble in boiling nitric acid with evolution of hydrocyanic acid; also soluble in ammonia water and in solution of sodium hyposulphite, or of potassium cyanide. When heated the salt fuses, gives off cyanogen gas, and on ignition leaves a residue of metallic silver, amounting to 80.56 per cent of its original weight"—(*U. S. P.*). Chlorine water and heated solutions of iodides and chlorides decompose this salt, hydrocyanic acid being evolved. Silver chloride and hydrocyanic acid are produced by the action of diluted hydrochloric acid on this salt. Solution of potassium cyanide is the best solvent for silver cyanide, a double cyanide being formed. "Silver cyanide should be kept in dark amber-colored vials, protected from light"—(*U. S. P.*).

Use.—It is used chiefly in preparing extemporaneously diluted hydrocyanic acid.

ARGENTI IODIDUM (U. S. P.)—SILVER IODIDE.

FORMULA: AgI. MOLECULAR WEIGHT: 234.19.
SYNONYM: *Argentum iodatum.*

Preparation.—Dissolve separately equal parts of pure potassium iodide and pure silver nitrate in about 12 parts of water, and pour gradually into the potassium iodide solution the solution of silver nitrate, stirring the mixture constantly. Filter and wash the precipitate thoroughly with distilled water, and dry the product upon unsized paper. According to H. Vogel a slight excess of the potassium iodide insures greater stability of the salt when exposed to light. "Silver iodide should be kept in dark amber-colored vials, protected from light"—(*U. S. P.*).

Description and Tests.—The Pharmacopœia describes silver iodide as "a heavy, amorphous, light-yellowish powder, unaltered by light, if pure, but generally becoming somewhat greenish-yellow, and having neither odor nor taste. Insoluble in water, alcohol, diluted acids, or in solution of ammonium carbonate, but soluble in about 2500 parts of stronger ammonia water. It is also dissolved by an aqueous solution of potassium cyanide and by a concentrated solution of potassium iodide, and the resulting solutions yield a black precipitate with hydrogen sulphide T.S. or ammonium sulphide T.S. When heated to about 400° C. (752° F.), the salt melts to a dark red liquid, which, on cooling, congeals to a soft, yellow, slightly transparent mass. When mixed with ammonia water it turns white, but regains its yellowish color upon being washed with water. If a small quantity of chlorine water be agitated with an excess of the salt, the filtrate acquires a dark blue color on the addition of starch T.S. If 0.5 Gm. of the salt be digested for five minutes with 10 Cc. of a cold 15 per cent solution of ammonium carbonate, the filtrate, when supersaturated with nitric acid, should not be rendered more than faintly opalescent (absence of chloride). On digesting a portion of the salt—which has been found to be free from chloride, or from which the latter has been completely removed by repeated digestion with ammonium carbonate—for five minutes with 10 Cc. of ammonia water, and supersaturating the filtrate with nitric acid, only a slight opalescence, but no yellowish-white precipitate, should be produced (absence of bromide)"—(*U. S. P.*). This salt sublimes at a white heat. When strongly heated on charcoal with a blowpipe flame it ignites, producing a green blaze and giving off a white smoke, leaving a small residue of metallic silver. When this salt is fused it assumes yellow, red, and deep-brown hues, according to the degree of heat employed. Water reprecipitates it from its potassium iodide solution.

Action, Medical Uses, and Dosage.—A practically obsolete medicine, formerly given in ⅛ grain to 2 grain doses in *whooping-cough*, *asthma*, *chorea*, *visceral* *neuralgia*, and *syphilis*. Dr. Charles Patterson, of Dublin, found it to act in various diseases as a substitute for nitrate of silver, producing its therapeutical influences without discoloring the skin. The dose for an adult is 1 or 2 grains, in pill, every 3 or 4 hours.

ARGENTI NITRAS (U. S. P.)—SILVER NITRATE.

FORMULA: $AgNO_3$. MOLECULAR WEIGHT: 169.55.

Preparation.—"Two parts of pure silver in small pieces are to be dissolved in 3 parts of pure nitric acid, specific gravity 1.41, diluted with 1½ parts of distilled water, at a gentle sand-bath heat, and the clear solution—after decanting and filtering the last portions, if necessary—evaporated in a porcelain dish, at first over an open fire, and afterward, when it has become thick, under constant stirring with a glass rod, to perfect dryness in a sand-bath. On account of the nitrous vapors that are evolved this process should be performed under a chimney with a good draught. If the crystallized salt is required, the dried mass is again dissolved in its weight of distilled water, and allowed slowly to evaporate in a sand-bath to about half; it is then placed for some days in a cool spot, the mother liquors poured from the separated crystals, and again slowly evaporated. The crystals are not dried on paper, but drained in the vessel in which they formed, dried and kept in a bottle excluded from the light. When required in sticks a portion is fused over a spirit lamp, in a porcelain dish, being constantly stirred with a glass rod, and the liquid mass poured into a bright iron mold that has been previously warmed. The sticks as soon as cold are removed, and the tubes wiped with dry filtering paper, to remove any adhering salt. Eight parts of pure silver yield 12 parts of nitrate" (Witt.). The reaction involved in this process is as follows: $Ag_3+4HNO_3=3AgNO_3+NO+2H_2O$. $NO+O=NO_2$.

All organic matter must, from this as well as all other silver salts, be carefully excluded, as they facilitate their reduction and discoloration, consequently the crystals must not be dried on filtering paper. It is sometimes recommended to rub the surface of the mold with oil, but this is unnecessary and inadvisable, as the sticks slide equally well out of the dry and polished cylinders, and the oil will cause a gray appearance on their outer surface. The salt must be poured into the mold as soon as it is liquefied, because it soon begins to evolve nitric acid, and the oxide formed becomes reduced to a gray metallic covering which is prejudicial to the appearance of the preparation. If such a pellicle has formed (it will mostly remain in the dish after pouring out the fluid portion) a few drops of pure nitric acid must be added to the next portion of the salt, previous to fusing it. The salt must not be fused in an iron vessel.

Description.—"Colorless, transparent, tabular, rhombic crystals, becoming gray or grayish-black on exposure to light in presence of organic matter; without odor, but having a bitter, caustic, and strongly metallic taste. Soluble at 15° C. (59° F.) in 0.6 part of water and in 26 parts of alcohol; in 0.1 part of boiling water, and in 5 parts of boiling alcohol. When heated to about 200° C. (392° F.) the salt melts, forming a faintly yellow liquid, which, on cooling, congeals to a pure white, crystalline mass. At a higher temperature it is gradually decomposed with evolution of nitrous vapors"—(*U. S. P.*). The presence of hydrogen sulphide will also cause the crystals of silver nitrate to turn black. The sticks or rods of the salt are at first white, but from the action of light and organic matter become grayish, and when broken they present a crystalline texture with a radiated surface. They differ from the crystallized nitrate only in form and color, and do not contain any water of crystallization, as has been supposed. Nitrate of silver, especially in solution, should always be kept in dark, amber-colored bottles with glass stoppers, as cork quickly decomposes it. It is a heavy, non-deliquescent, anhydrous salt, and is incompatible with all waters containing salt, phosphorus, charcoal, vegetable astringent solutions, chlorides, most acids and their salts, earths, and alkaline solutions. Its specific gravity is 3.521. It corrodes the soft tissues, and in contact with the hair, skin, nails, linen, and almost all organic substances, it produces stains of an indelible black—(Ed.). Stains of nitrate of silver may be removed by first applying a strong solution of iodide of potassium, and afterward a solution of hyposulphite of sodium; or a solution of cyanide of potassium will remove them; or the application of tincture of iodine, and afterward liquor potassæ, or solution of sodium hyposulphite.

Tests.—Fused nitrate of silver almost always contains a small proportion of free silver when in sticks, which may be known by the undissolved black powder present in its solution in distilled water. Precipitate a solution of nitrate of silver by an excess of chloride of sodium; if this precipitate is entirely soluble in ammonia the salt is pure; if not, lead is present. Hydrogen sulphide gas passed through the liquid, after having removed the above precipitate, gives a white precipitate if zinc be present, and black if there be any copper. Nitrate of potassium may be suspected when a colorless fracture is presented upon breaking the sticks, and when the salt is entirely soluble without the black powder sediment. It is readily distinguished by precipitating all the silver as chloride by means of hydrochloric acid, and evaporating to dryness, when the nitrate of potassium will be found in the residue. "An aqueous solution of the salt is neutral to litmus paper, and yields, with hydrochloric acid, a white precipitate, which is readily dissolved without color (absence of copper) by ammonia water. If 5 Cc. of a 10-per-cent aqueous solution of the salt be mixed with 20 Cc. of diluted sulphuric acid, and heated to boiling, no turbidity should be perceptible (absence of lead). If another portion of the aqueous solution be completely precipitated by hydrochloric acid, and the filtrate evaporated to dryness, no residue should be left (absence of foreign salts). 0.34 (0.3391) Gm. of silver nitrate dissolved in 10 Cc. of water should require, for complete precipitation, 20 Cc. of decinormal sodium chloride V.S. (corresponding to 100 per cent of the pure salt)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Applied to the tissues silver nitrate coagulates the albumen and fibrin of the parts, forming a white pellicle, which may become dark and quickly dries. Intense smarting or burning pain attends its application. Ulceration and sloughing may supervene from its use as a caustic, but the mitigated stick and the solutions are quite superficial in action. It stains the tissues dark or black, which stains may be permanent if often repeated. When swallowed, pain, heat, and vomiting, and other distress indicative of an irritant poison are experienced. There may be a feeble pulse, cold, clammy perspiration, anæsthesia, unconsciousness, loss of muscular power, and convulsions. Paralysis of central origin may result from its use. The only symptom from its long-continued use internally in small doses is a peculiar dark line upon the gums and conjunctiva, followed by a discoloration of the skin of a dingy or slate color. This condition, known as *argyria*, is permanent, and is produced by the deposit of silver in metallic form in the pigmentary portion of the skin.

Some practitioners consider this salt a tonic and nerve-stimulant, allaying irritability of the nerve centers, and improving nutrition, and employ it to fulfil these indications in *epilepsy*, *chorea*, *angina pectoris*, etc., as well as administering it in *intestinal ulceration* during *typhoid fever*, *diarrhœa*, etc. It has largely lost favor in these complaints, though it is recommended by some as an internal agent in *perforating gastric ulcer*, *gastric catarrh*, *flatulent dyspepsia*, and *gastralgia*. Also in ulcerative or non-ulcerative *chronic diarrhœa*, *dysentery*, with pinkish blood-streaked mucoid discharges, and in *cholera infantum* to allay chronic irritation and assist the recuperative powers of the membranes when feeble. The dose for this purpose should be very small, from $\frac{1}{100}$ to $\frac{1}{20}$ grain; some recommend from $\frac{1}{6}$ to $\frac{1}{2}$ grain. We believe we possess better remedies for these disorders. However, it is seldom used as an internal agent, but externally as an escharotic, either in the solid form, or dissolved in distilled water. It has been beneficially applied to *sluggish ulcers*, *warts*, and other growths, *fungous flesh*, *chancres*, and in *ulcers of the cornea*, some forms of *ophthalmia*, *granulation of the lids*, *fetid discharges from the ear*, *aphthous affections of mouth*, and *spongy gums*. It has likewise been recommended as a topical remedy in *erysipelas* and various other *external inflammations*, *leucorrhœa*, *gonorrhœa*, *uterine ulcerations*, *granulations* and *excoriations*, and *stricture of the urethra* (care should be had in its use in the urethra); also in *ringworm*, and some other forms of *chronic cutaneous diseases*. A solution of it is highly recommended in *chronic laryngitis*, *pharyngitis*, *pertussis*, *asthma*, and *venereal ulceration of the throat*, applied by means of a sponge fastened to one end of a piece of whalebone. It has more recently been used in the form of spray in *tracheal, laryngeal, nasal,* and *faucial diseases*—1 to 10 grains of the salt to 1 fluidounce of distilled water, and sprayed upon the affected parts every day or two, or even oftener. A caustic solution should not be passed into the lungs or bronchi. The solid stick is sometimes used in *ulcerations of the throat* and *chilblains.* A modified nitrate of silver is much used in *trachoma* and other affections of the eye. In eye disorders the greater the inflammation the stronger should be the application, and as the severity of the symptoms decline the strength of the application should be reduced. In *catarrhal trachoma* a 25 per cent solution or the mitigated stick may be used. In *corneal ulcer* a 5 per cent solution may be applied after curetting the lesions. In such ulcers, however, care should be had that no deposit of silver should take place and thereby obscure vision. Solutions of silver nitrate should not be dropped into the ear, but if to be applied should be carried upon cotton, or fused to a fine wire. *Perforation of the drum* refusing to heal after *suppurative otitis media* should be treated with the agent upon a wire, simply touching the margin of the perforation. Closure follows. *Non-confluent exuberant granulations* and *redundant tissues,* after operations, should be treated with it, either in solution or by stick. In *gonorrhœal ophthalmia* and *ophthalmia neonatorum:* ℞ Silver nitrate, grs. v to x; aqua dest., fl℥i. Mix. Wash the eye well with warm water and apply (Locke). It is well to have salt water at hand to limit its action if desired.

Gonorrhœa of the female is amenable to it, and for *leucorrhœa* dependent upon irritation and subacute inflammation: ℞ Silver nitrate, grs. iii to iv; aqua dest., fl℥i. Mix. Apply with a swab or syringe (Locke). In *gonorrhœa* of the male silver nitrate in solution sometimes cures, but more often aggravates the disease. Painting the scrotum with a solution is said to sometimes abort *epididymitis. Felons* are occasionally aborted in the same manner. In *erysipelas* it is inferior to tincture of chloride of iron.

In using silver nitrate if the pain be excessive from the application it may be at once relieved by washing the parts with a solution of common salt, which decomposes it, and converts it into the insoluble chloride of silver. The same article is an antidote to its poisonous effects when taken internally in too large doses. In obstinate or severe *dysentery,* after having first cleansed the rectum by an injection of soap and warm water, another injection, composed of nitrate of silver 10 grains, distilled water 1 fluid ounce, may be given, and repeated in an hour if necessary. The second or third injection is said to cure. For a child less than a year old, 1 grain of the nitrate to the fluid ounce of water, and so in proportion (W. H. Parsons, *College Journal,* Cincinnati, Ohio, III, 269). Its use in this manner has been practically abandoned, though it may be resorted to in extreme cases. The dark color of the skin produced by the internal use of nitrate of silver generally remains for life. A premonitory indication of this discoloration is the appearance of a dark-blue line along the margins of the gums, darker than that caused by the internal use of lead. Duncan states that it is said to be at last removed by a steady course of cream of tartar; and Pereira suggests to wash the body with diluted nitric acid daily, at the same time administering it internally. Others advise the use of iodide of potassium during the period of taking the silver salt. For the purpose of operating with greater safety in cavities where the fracture of the caustic might be dangerous, Chaissaignac employed nitrate of silver fused round a platinum wire; thus applied it adheres firmly to the wire, even when cracked; or aluminum wire might be substituted for the platinum.

The dose of the crystals of nitrate of silver is from $\frac{1}{6}$ to $\frac{1}{4}$ of a grain, repeated 3 times a day, and gradually increased to 2 or 3 grains. It may be given in pill form with bread-crumb, or in solution largely diluted, but preferably in pill with some vegetable extract. When employed locally in solution its strength is varied, according to the condition of the parts to be acted upon and the character of the affection—from 5 to 80 grains to the fluid ounce of water.

Specific Indications and Uses.—Intense tormina and tenesmus, with discharge of pinkish, blood-streaked mucus in dysentery, or pinkish, blood-streaked discharges in diarrhœa, with flatulence, mucorrhœa, and cardiac palpitation.

Indelible Ink.—Indelible ink for marking linen, etc., owes its character to this salt. "An ink for marking linen has been largely used, which does not require a mordant, flows freely from the pen, does not require a strong or long-continued heat to develop the black mark, and which will not destroy the texture of the finest cambric. It is prepared thus: Dissolve nitrate of silver, 1 ounce, in a sufficient quantity of distilled water; also dissolve crystallized carbonate of sodium, 1½ ounce, in sufficient distilled water. Mix the two solutions; a precipitate ensues which must be collected and washed on a filter. Introduce the washed precipitate, still moist, into a Wedgewood mortar, and add to it tartaric acid 160 grains, rubbing them together until effervescence has ceased; add strong aqua ammoniæ in sufficient quantity to dissolve the tartrate of silver (about 2 ounces); then mix in archil ½ fluid ounce; white sugar, 4 drachms; powdered gum arabic, 12 drachms, and add distilled water sufficient, if required, to make 6 fluid ounces of the whole mixture." (Adapted from *Am. Jour. of Pharm.*, XIX, 103).

Silver and Its Salts.—ARGENTUM, SILVER. SYMBOL: Ag. ATOMIC WEIGHT: 107.66. *Argentum purificatum*, *Refined silver*. This well-known metal, called by the ancient alchemists *Luna*, or *Diana*, has been known from biblical times. Pliny mentions the preparation of silver in his writings. It is found in European countries, as Spain, Germany, Norway, and Russia, and also abundantly in Mexico, Peru, and the Western portion of the United States, all of these places yielding very rich argentiferous ores. It is also found native, often forming large masses. It is also found in combination with sulphur and various metals, notably lead, gold, copper, and arsenic, and with iodine, bromine, and chlorine. Sea water contains some silver. A large amount is obtained from *galenite* (lead sulphide), in which silver exists as a frequent accessory constituent. In fact, silver is often produced as a by-product in the production of lead, and *vice versa*. There are several methods of extracting silver from its ores. We will briefly notice but two. The first is the *amalgamation process*. The finely-powdered silver ore, with sodium chloride is put into a reverberatory furnace and roasted, thereby producing silver chloride. The roasted mass is then mixed with water so as to form a thin paste, and agitated with scrap-iron in revolving casks, or cylinders, this process being conducted for many hours. The object of this is to abstract the chlorine, as is shown by the following equation: $2AgCl+Fe=FeCl_2+Ag_2$. Then mercury is added, the agitation continuing until a silver-mercury amalgam is produced. This amalgam is then distilled, the mercury passing over, and the silver, often containing gold and copper, remains as a residue. A second method is that known as *cupellation*. If the argentiferous lead ore contains less than $\frac{1}{10}$ of 1 per cent of silver it is first put through Pattison's process of concentration—that is, of melting it and allowing it to partially cool, on which lead crystals separate, which are removed with a strainer-ladle. This leaves a richer alloy behind, which is remelted, and the foregoing process repeated until the alloy is so rich as to contain at least 300 ounces of metallic silver to the ton. This is then *cupelled*—that is, melted, in the presence of an air-blast, on a porous, bone-ash bed, the lead becoming oxidized as litharge, while nearly pure silver remains. Silver obtained in this manner on a large scale is always contaminated with other metals. There are several methods of purification. One of these is to separate the silver in the form of insoluble silver chloride by precipitating a nitric acid solution of the metal with hydrochloric acid and washing the precipitate well with distilled water. Boiling this precipitate with sodium carbonate and glucose reduces it to a powder of metallic silver, which, after being thoroughly washed with acetic acid and distilled water, may be fused as pure silver. Silver is a soft, white, brilliant, tough metal, malleable and capable of taking a high polish. It may crystallize in regular octohedrons. It may be hammered into a thin leaf known as *argentum foliatum* or *silver leaf*, and it is so ductile that it may be drawn into a fine *silver wire*. It is the best conductor of heat and the electrical current. It volatilizes, boils, and distills completely at a white heat produced in the oxyhydrogen flame. At 1000° C. (1832° F.) it fuses with the absorption of oxygen, which is expelled when the silver cools, exhibiting the peculiar phenomenon known as the "spitting" of silver. At the ordinary temperature or at a red heat it refuses to oxidize. Hydrochloric acid does not dissolve silver, but it is easily dissolved by nitric acid. Exposed to the air it becomes superficially tarnished by the hydrogen sulphide of the atmosphere. Sulphur unites with it to form a sulphide, as is seen when a silver spoon is blackened by eggs, onions, etc. Silver precipitated from solutions by various reducing agents may be obtained in several allotropic forms, some soluble, and most of them capable of being powdered by trituration. The modifications are variously colored, green, lilac, blue, reddish-brown, and gold-colored, according to the substance employed as a reducing agent (see Carey Lea, *A. P. A. Proceedings*, 1890–91–92). The density of silver varies, distilled silver being 10.575; pressed silver, 10.57, and fused silver, 10.42 to 10.51. Silver is not used in medicine, except as silver-leaf for coating pills. It is largely used for silvering appliances and instruments, and furnishes silver sutures for the surgeon. It is extensively used in the arts for plating purposes, and is an all-important agency in photography. Combined with varying amounts of copper to give it hardness, it furnishes the silver coin of the world. Of its salts the nitrate is the most important.

ARGENTI CHLORIDUM ($AgCl$.), *Silver chloride*.—Prepared by adding to a silver nitrate solution one of common salt in excess (or hydrochloric acid) until it no longer precipitates. A white curdy substance is formed, which agglutinates upon shaking. If exposed to light it darkens. Filter and dry in the dark at a gentle heat. The caustic alkalies, but not the alkaline carbonates, decompose it, producing silver oxide. When found native this salt has been called *horn silver*. It is soluble in 3072 parts of water, soluble in ammonia, and gradually acquires a purple color on exposure to the air. At 260° C. (500° F.) it fuses, and on cooling forms a gray, semi-transparent mass, called *luna cornea*, from its resemblance to horn. Its specific gravity is 5.129; that of the native chloride is 5.552. This salt was recommended by Dr. Perry in *epileptic disease*, *chronic affections of the bowels*, and as a substitute in many diseases for the nitrate of silver, in doses of 2 or 3 grains every 3 or 4 hours. It is generally used in doses of from 1 to 3 grains 3 or 4 times a day in complaints in which silver nitrate is employed.

SILVER AMMONIO-CHLORIDE crystallizes in cubes when a heated solution of ammonia is saturated with silver chloride, and the mixture allowed to cool in closed bottles. In doses of 1/8 grain, it has been employed in *syphilitic disorders*.

ARGENTI NITRAS DILUTUS (U. S. P.)—DILUTED SILVER NITRATE.

SYNONYMS: *Mitigated caustic, Argenti et potassii nitras, Lapis infernalis nitratus, Argentum nitricum fusum mitigatum, Nitrate of silver and potassium.*

Preparation.—"Silver nitrate, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; potassium nitrate, sixty grammes (60 Gm.) [2 oz. av., 51 grs.]. Melt the salts together in a porcelain crucible, at as low a temperature as possible, stirring the melted masses well until it flows smoothly. Then cast it into suitable molds. Keep the product in dark, amber-colored vials"—(*U. S. P.*).

This preparation is a mitigated form of fused silver nitrate, containing 33⅓ per cent of pure argentic nitrate. If sodium nitrate (Chili saltpeter) be substituted for potassium nitrate the pencils are liable to become hygroscopic on the surface if exposed to moist air. The addition of the potassium salt, like the silver chloride in *molded silver nitrate*, renders it opaque and less fragile than *pure fused* argentic nitrate, and is employed in this form especially as diluent. The diluted silver nitrate of the *U. S. P.*, 1880 (*Lunar Caustic*, No. 3), contained 50 per cent of silver nitrate; a commercial form, containing 67 per cent of silver salt, has long been known as "*Lunar Caustic*, No. 2."

Description and Tests.—"A white, hard solid, generally in the form of pencils or cones of a finely granular fracture, becoming gray or grayish-black on exposure to light in presence of organic matter; odorless, having a caustic, metallic taste, and neutral to litmus paper. Each of its constituents retains the solubility in water and in alcohol mentioned, respectively, under argenti nitras and potassii nitras. An aqueous solution of diluted silver nitrate yields, with a slight excess of hydrochloric acid, a white precipitate, which is readily soluble in ammonia water. The filtrate from this precipitate, when evaporated to dryness, yields a white residue which is completely soluble in water, and this solution affords a yellow, crystalline precipitate with platinic chloride T.S. and a white, crystalline precipitate with sodium bitartrate T.S. If to an aqueous solution of diluted silver nitrate a slight excess of ammonia water be added, it should neither assume a blue color (absence of copper) nor show any turbidity (absence of lead and bismuth). If 1 Gm. of diluted silver nitrate, dissolved in 10 Cc. of water, be mixed with 20 Cc. of decinormal sodium chloride V.S. and a few drops of potassium chromate T.S., not more than 0.5 Cc. of decinormal silver nitrate V.S. should be required to impart to the liquid a permanent red color (corresponding to at least 33 per cent of pure silver nitrate)"—(*U. S. P.*).

Action and Medical Uses.—Same as silver nitrate (which see); applicable where a mild application is desired.

ARGENTI NITRAS FUSUS (U. S. P.)—MOLDED SILVER NITRATE.

SYNONYMS: *Lunar caustic, Lapis infernalis, Azotas argenticus fusus, Fused nitrate of silver, Nitras argenticus fusus.*

Preparation.—"Silver nitrate, one hundred grammes (100 Gm.) [3 oz. av., 231 grs.]; hydrochloric acid, four grammes (4 Gm.) [62 grs.]. To the silver nitrate, contained in a porcelain capsule, add the hydrochloric acid, and melt the mixture at as low a temperature as possible. Stir well, and pour the melted mass into suitable molds. Keep the product in dark, amber-colored vials, protected from light"—(*U. S. P.*).

Description, History, and Tests.—*Pure* fused nitrate of silver yields a very brittle pencil, hence the allowance of 5 per cent of chloride of silver in *molded silver nitrate* (as produced by the above process), giving the stick a greater degree of toughness, so that it can be more easily sharpened and used without readily breaking. This form of lunar caustic is the most economical on this account, inasmuch as it lacks but little of being pure silver nitrate. The addition of silver chloride to the pure fused silver nitrate was proposed by Dr. E. R. Squibb, in 1858.

The *U. S. P.* describes molded nitrate of silver as follows: "A white, hard solid, generally in the form of pencils or cones of a fibrous fracture, becoming gray or grayish-black on exposure to light in the presence of organic matter, odorless, and having a bitter, caustic, and strongly metallic taste. Soluble at 15° C. (59° F.), with the exception of about 5 per cent of silver chloride, in 0.6 part of water and in 26 parts of alcohol; in 0.1 part of boiling water and in 5 parts of boiling alcohol. The portion left undissolved by water should be completely soluble in ammonia water. A clear, aqueous solution of the salt, decanted from the insoluble portion, should be neutral to litmus paper, and should respond to the tests of identity and purity mentioned under argenti nitras. If 0.34 Gm. of molded silver nitrate, dissolved as completely as possible in 10 Cc. of water, be mixed with 20 Cc. of decinormal sodium chloride V.S. and a few drops of potassium chromate T.S., not more than 1 Cc. of decinormal silver nitrate V.S. should be required to impart to the liquid a permanent red color (corresponding to 95 per cent of pure silver nitrate)"—(*U. S. P.*).

Action and Medical Uses.—(See *Silver nitrate*).

ARGENTI OXIDUM (U. S. P.)—SILVER OXIDE.

FORMULA: Ag_2O. MOLECULAR WEIGHT: 231.28.

SYNONYMS: *Argentum oxydatum*, *Argentic oxide*, *Oxidum argenticum.*

"Silver oxide should be kept in dark, amber-colored vials. It should not be triturated with readily oxidizable or combustible substances, and should not be brought in contact with ammonia"—(*U. S. P.*).

Preparation.—To a solution of nitrate of silver add a solution of caustic potash as long as any precipitate falls; collect the brown precipitate on a filter, wash it repeatedly until the washings are almost tasteless, and dry it at a heat of about 82.2° C. (180° F.). This is practically the process of the *U. S. P.*, 1870. The British process is: "Take of nitrate of silver, in crystals, ½ ounce (av.); solution of lime, 3½ pints (Imp.); distilled water, 10 fluid ounces. Dissolve the nitrate of silver in 4 ounces of the distilled water, and, having poured the solution into a bottle containing the solution of lime, shake the mixture well, and set it aside to allow the deposit to settle. Draw off the supernatant liquid, collect the deposit on a filter, wash it with the remainder of the distilled water, and dry it at a temperature not exceeding 100° C. (212° F.). Keep it in a stoppered bottle"—(*British Pharmacopœia*).

It is essential in these processes that the absence of chlorides and carbonates be insured, lest the product become contaminated with silver chloride or carbonate. The silver nitrate is decomposed, and accordingly, as lime or potassa is employed, the result will be the precipitation of silver oxide and calcium or potassium nitrate. Gregory recommended its preparation from freshly prepared, moist silver chloride, boiling it with solution of potassa (in excess) until diluted nitric acid would dissolve a portion of the product. By this method a black or blue-black powder is obtained.

Description and Tests.—"A heavy, dark, brownish-black powder, liable to reduction by exposure to light, odorless, and having a metallic taste. Very slightly soluble in water, to which it imparts an alkaline reaction, and insoluble in alcohol, but readily and completely soluble in nitric acid without effervescence (absence of carbonate). When heated to about 250° to 300° C. (482° to 572° F.) it is rapidly decomposed, with the evolution of oxygen, and leaving a residue of metallic silver"—(*U. S. P.*). This body readily gives up its oxygen, hence the caution given at the head of this article. When exposed to sunlight it turns black, giving off oxygen, a change which slowly takes place in the mere light, and rapidly when heated. When kept moist it gradually changes to a carbonate. It is insoluble in the fixed alkalies, readily soluble in ammonia, and about 3000 parts of water dissolves 1 part of the oxide. With caustic ammonia it forms a black fulminating powder (*Berthollet's fulminating silver*), on which account the experimenter should be careful about using ammonia with it, or for preparing it, as it is always attended with danger. Dangerously explosive black crystals of the same are deposited from the ammoniacal solution. "The solution of the oxide in nitric acid should be colorless, and should respond to the reactions and tests mentioned under silver nitrate (see argenti nitras). If 0.5 Gm. of the oxide be ignited in a porcelain crucible, it should yield 0.465 Gm. (or 93.1 per cent) of metallic silver"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—The internal uses of this agent are much the same as those of silver nitrate, though it is less energetic. Oxide of silver has been employed in *neuralgic* and *irritable conditions* of the stomach and bowels, in *dyspepsia*, *water-brash*, *chronic diarrhœa*, and *dysentery*, *epilepsy*, etc. In *uterine diseases*, attended with great irritability and augmented discharges, it has been found especially beneficial, as in *hysteralgia*, *menorrhagia*, *dysmenorrhœa*, and *leucorrhœa*. Its use has occasioned salivation. Pereira states that its long-continued use will occasion a permanent coloration of the skin. A drachm of the oxide to 1 ounce of lard forms an ointment, which has been used in *irritable ulcers*, both syphilitic and non-syphilitic, in *sore nipples*, and in *gonorrhœa*, applied to the urethra by means of a bougie. The dose is from ½ grain to 2 grains, 2 or 3 times a day, in the form of a pill or powder.

ARMORACIA.—HORSERADISH.

The fresh root of *Cochlearia Armoracia*, Linné (*Cochlearia rusticana*, Lamarck; *Armoracia rusticana*, Gærtner; *Armoracia sativa*, Heller).

Nat. Ord.—Cruciferæ.

COMMON NAME: *Horseradish.*

Botanical Source.—Horseradish root, very tenacious of life, is a perennial, thick, tapering, white, long, acrid, and from which arise many large leaves. From the center a round or angular, smooth, erect, branching stem arises, about 2 feet in height; those branches which flower are corymbose, smooth, and angular. The radical leaves are nearly a foot long, half as wide, oblong, crenately-toothed, waved, sometimes pinnatifid, of a dark-green color, and upon long, channeled petioles; the cauline leaves are smaller, lanceolate, dentate, or incised, sessile, sometimes entire, and without footstalks; the lower ones are often pinnatifid. The flowers are numerous, small, white, peduncled, and borne in terminal corymbose racemes. Calyx ovate, spreading, and equal at the base; sepals four, concave. Petals obovate, obtuse, entire, claw-like. Stamens without teeth, the length of the calyx; anthers cordate; silicle sessile, oblong, or ovoid-globose, and compressed; dissepiment thin; valves ventricose, thickish; cells many seeded; seeds not bordered, and cotyledons flat and accumbent (G.—W.—L.).

History and Description.—This well-known succulent plant is a native of Europe, and extensively cultivated for the use of its root as a condiment. It flowers in June. The fresh root is the official part, and should be dug in the autumn, as its acrimony is then the strongest; it may be preserved for some time fresh by burying it in a cool place in sand. The root is whitish-yellow externally, white internally, of various lengths tapering to a point, from ½ inch to 2 inches or more in diameter at its thickest part, fibrous, fleshy, succulent, of a very pungent taste and odor, producing a flow of tears, and when smelt, violent sneezing. The root is surmounted by several annulated heads. It breaks with a short fracture. Water, alcohol, or vinegar extracts its properties, which are due to the presence of a volatile oil, and which is dissipated by heat or desiccation. Fresh aconite root has been eaten by mistake for horseradish, probably on account of their somewhat similar appearance and odor when fresh.

Chemical Composition.—This root contains a volatile oil, its principal constituent, which passes over when the root is distilled with water; it is of a light-yellow color, possessing the pungent properties of the plant in a high degree, causing irritation and even blistering when in contact with the skin. It is supposed to be perfectly identical with the volatile oil of mustard, and is obtained in minute proportion, 6 parts only of the oil being procured from 10,000 of the root. It is believed not to exist already formed in the unbroken root, but to be developed by the mutual reaction of its constituents when the root is bruised. Dr. A.W. Hoffman, however, has found these two oils to be entirely different, the oil of cochlearia boiling at 160° C. (320° F.), while the oil of mustard boils at 146.6° C. (296° F.); treated with ammonia the oil of horseradish yields a beautifully crystallizing substance, *thiosinamin*, which fuses at 135° C. (275° F.). The dried root possesses no pungency, and yields no volatile oil when distilled with water, unless white mustard be added, the *myrosin* of the mustard supplying some necessary principle destroyed by desiccation. In addition the root contains a bitter resin, sugar, gum, starch, extractive, albumen, acetic acid, acetate and sulphate of calcium, water, and lignin. Various other salts and acids were found in the ash by Hilger.

Action, Medical Uses, and Dosage.—Stimulant, sialagogue, diuretic, antiscorbutic, and rubefacient. The pungent and acrid nature of the fresh root, with the faucial and nasal irritation and consequent lachrymation, are well-known effects to those who use it as a condiment. Burning pain at the epigastrium, nausea, and vomiting follow an immoderate dose. Externally applied it is rubefacient and may vesicate. It promotes all the secretions, the urinary in particular, and stimulates the stomach when this organ is enfeebled. By its sialagogue and stimulant effects upon the gastric membranes it promotes digestion. The infusion is emetic. It has been used with advantage in chronic affections attended with debility of the digestive organs, and of the general system, as in *paralysis*, *rheumatism*, *dropsy*, and as an antiscorbutic in *scurvy*. In *dropsy* an infusion of the root in cider, and drank as warm as could be borne, in large quantities and freely, the patient being warmly covered up, has caused copious diuresis and diaphoresis, and cured the disease in a few weeks; the operation being repeated nightly, or as the strength of the patient would permit. Horseradish was formerly much employed to produce abortion, frequently effecting this object, when other internal agents failed; it was used as follows: A saturated infusion of the recent roots in whiskey was made, of which 4 fluid ounces was the dose, repeating it 3 or 4 times every day, and continuing its use until the desired effect was produced. Locally the vinegar infusion is said to remove *tan* and *freckles*. The grated root, with sugar and water to form a syrup, is excellent for *hoarseness*; a spoonful or two may be swallowed as occasion requires. It has been also used externally as a rubefacient. Dose of the root grated, from 1 to 2 drachms.

The *Cochlearia officinalis*, or *Scurvy grass*, is seldom used in medicine; it possesses similar properties.

Specific Indications and Uses.—Hoarseness from relaxed faucial tissues; gastric debility. It is a remedy for atonic conditions only.

ARNICA.—ARNICA.

The flower heads, rhizome, and roots of the *Arnica montana*, Linné.

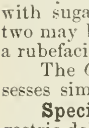
Nat. Ord.—Compositæ.

Common Names: *Arnica*, *Leopard's bane*.

Illustration: Bentley and Trimen, *Med. Plants*, 158.

Botanical Source.—Arnica montana is a rather hairy plant, with a dark or blackish root, from which are given off numerous radicles. The stem is simple, pubescent, rough, obscurely angled, striated; one to three-headed and from 10 to 12 inches in height. The leaves are entire and opposite; the radical ones obovate or oblong, ciliated, five-nerved; the cauline in one or two pairs. The flowers are large, orange-yellow; in erect or drooping heads. The involucre is cylindrical and rough with glands. There are many tubular, five-lobed disk-florets, and about fourteen strap-shaped, three-toothed, striated ray-florets, downy at the base. The achenia are somewhat cylindrical, downy, ribbed, and blackish, with a straw-colored, hairy pappus.

Fig. 29.



Arnica montana.

History and Description.—This perennial herb inhabits Siberia; also the cooler parts of Europe from the sea coast to the limits of constant snow; in moist, shady situations, flowering in June and July; it is likewise found in the northwestern parts of the United

States The whole plant has been used in medicine; more especially the flowers. The flowers are compound, radiated, yellow, with a calyx of linear equal follicles, the length of the disc, ligulate, floscules twice the length of the disc, two lines broad, three-toothed, with a sessile pappus, fragile and somewhat scabrous; taste acrid and bitterish; the dust is unpleasant, and causes sneezing. The odor is unpleasant, but is much diminished, as well as the taste, by drying. They yield their properties to water or alcohol. The dried root is about the thickness of a small quill, flexuous, bark brown externally, rugose longitudinally, with a somewhat hard, whitish wood, larger pith, and long, dense radicles on one side; its taste is aromatic, acrid, and slightly bitter. It should be gathered in the spring. Arnica flowers are liable to adulteration with various composite flower-heads, as anthemis, inula, and calendula. As these differ considerably botanically, there will be no difficulty in detecting the spurious flower-heads.

The *Pharmacopœia of the United States* gives the following descriptions of the flowers and rhizome:

ARNICÆ FLORES (*U. S. P.*), *Arnica flowers.*—"Heads about 3 Cm. (1¼ inches) broad, depressed-roundish, consisting of a scaly involucre in two rows, and a small, nearly flat, hairy receptacle, bearing about 16 yellow, strap-shaped, ten-nerved ray-florets, and numerous yellow, five-toothed, tubular disk-florets, having slender, spindle-shaped achenes, crowned by a hairy pappus. Odor feeble, aromatic; taste bitter and acrid"—(*U. S. P.*).

ARNICÆ RADIX (*U. S. P.*), *Arnica root.*—"Rhizome about 5 Cm. (1¾ inches) long and 3 or 4 Mm. (⅕ to ⅙ inch) thick; externally brown, rough from leaf-scars; internally whitish, with a rather thick bark, containing a circle of resin-cells, surrounding the short, yellowish wood-wedges, and large, spongy pith. The roots numerous, thin, fragile, grayish-brown, with a thick bark containing a circle of resin-cells. Odor somewhat aromatic; taste pungently aromatic and bitter"—(*U. S. P.*).

Chemical Composition.—Pfaff found the root to contain volatile oil, acrid resin, extractive, gum and woody fiber. Chevallier and Lassaigne found the flowers to contain resin, a bitter, nauseous substance resembling *cytisin*, gallic acid, a yellow coloring matter, albumen, gum, chloride and phosphate of potassium, traces of sulphates, carbonate of calcium, and silica (T.).

In 1851 Mr. Bastick announced the existence of an alkaloid in the flowers, which he obtained in small quantity and called *arnicina* (*arnicine*). It is not volatile, bitter, slightly soluble in water, but more so in alcohol and ether. Its hydrochlorate is crystallizable (P.). Two bodies, known as *arnicin*, and derived from both the flowers and rhizome, have subsequently been isolated by two observers—Pavesi in 1859, and Walz, in 1861. The principles are totally unlike, though bearing the same name. Pavesi's *arnicin* is a disagreeably bitter, viscid resin, of a deep-yellow color, dissolving easily in alkaline solutions, from which acids precipitate it, and it dissolves sparingly and with difficulty in both ether and alcohol. Walz's *arnicin* (sometimes written *arnicine*, though different from Bastick's alkaloid), on the contrary, is an acrid, amorphous, golden-yellow mass, dissolving sparingly in water, and readily soluble in ether and alcohol. Alkalies also dissolve it. Recently *arnicine* was isolated from the flowers by Börner (*Am. Jour. of Pharm.*, 1893), who found for it the formula, $C_{12}H_{22}O_2$. It exists in the flowers to the extent of 4 per cent, and is obtainable from a concentrated acetone solution as a micro-crystalline mass, deliquescing after prolonged exposure, melts at 40° C (104° F.), and boils at 83° C. (181.4° F.); is golden-yellow, and easily soluble in ether, alcohol, acetone, benzole, insoluble in water and alkalies. He also found fat (glycerides of palmitic and lauric acids), and a hydrocarbon of the marsh-gas series. A small amount of *angelic* and *formic* acids have been obtained from arnica. Dragendorff obtained 10 per cent of *inulin* from the root (*Pharmacographia*).

The volatile oil, which is obtained most plentifully from the green rhizome, abounds to the extent of from 0.5 to 1 per cent, and has a specific gravity of 0.990 to 1.000 at 15° C. (59° F.), and contains *iso-butyric acid*, *phlorol-ester*, and *thymo-hydro-quinone-dimethyl-ether* (Schimmel & Co.'s *Semi-Annual Report*, October, 1893).

Action, Medical Uses, and Dosage.—Locally arnica is irritant, the preparations of the flowers being most powerful. Strong preparations should not be applied full strength, for in some instances of tender skin, or in accidents occuring after its use, an erysipelatous inflammation has followed. Even when used as a local dressing for wounds dangerous inflammation, with vesication, has occurred.

Internally, in large doses, arnica causes heat in the throat, nausea, vomiting, purging, spasmodic contractions of the limbs, difficulty of respiration, and sometimes inflammation of the alimentary canal, and coma. There is no known antidote to its poisonous influences; vegetable acids have been recommended. Two fluid ounces of the tincture has produced death.

In small doses arnica accelerates the pulse, increases the perspiration, excites a flow of urine, and is said to occasionally cause headache and giddiness. It is esteemed as a stimulant in *typhoid fever* and other *adynamic febrile diseases*, in *chronic palsy*, and *amenorrhœa;* also as a tonic in *chronic rheumatism*, and as a tonic and diuretic in the asthenic forms of *dropsy.* In *intermittent fever* it has proved very successful; also in *nyctalopia* and *amaurosis* (the best remedy); and is reputed to be highly efficacious in *constitutional derangements* caused by powerful shocks to the brain, from thumps, kicks, etc., in *internal pains*, and *congestions from bruises*, deficient action of parts, etc. It has also been recommended in cases of deficient nervous sensibility, languid vascular action, and almost every disease where there is debility, torpor, or inactivity of function. The conditions calling for arnica are those with evidences of spinal innervation. As a specific stimulant to the spinal nerves it is exceedingly prompt in advanced stages of disease, with feeble respiratory power and sleeplessness due to the same cause; also in lack of control over the voluntary discharges. It is indicated in *low typhoid states*, and in low forms of *typhus fever*, *diarrhœa*, and *dysentery*, always where there is marked depression and debility. In *typhoid pneumonia*, with marked asthenia and feeble circulation, great depression, low-muttering delirium, and tongue dry and loaded with foul mucus, it is one of the most efficient agents in use. Its action upon enfeebled respiratory efforts is much like that of phosphorus, as is also its effects in *sexual debility* from abuse, and in *paralytic states of the orifices* without active inflammation, particularly in the aged. Small doses are very efficient in *anemia* with weak circulation, general debility, and especially when associated with diarrhœa and dropsy, provided no inflammation is present (Locke). It is a remedy for *hectic fever*, with diarrhœa or excessive sweating. In *rheumatism*, with cold skin and debility, it arouses nervous action and stimulates excretion. It is a good agent in *myalgia*, and one of the best in muscular soreness and pain dependent upon strains, over-exertion, or other injuries. Here it should be applied locally in weak solutions and taken internally. The *nervous headache* of the debilitated and depressed calls for it, as does debility of the cardiac muscle due to excitement, over-activity, or "*heart-strain*." The dull aching in the præcordiæ, due to such over-action, is relieved by it. Prof. Scudder (*Spec. Med.*) writes: "I have frequently prescribed it for lame back, backache, and feelings of debility and soreness in the small of the back. It is only useful in those cases where there is feebleness, with deficient circulation; but in these the influence is direct and permanent."

Externally arnica is used in the form of an infusion, a fomentation, or diluted tincture of the flowers, both to prevent and discuss *local inflammations*, to remove *ecchymosis*, and as a dressing for *cuts*, *lacerations*, *contusions*, etc. For this purpose the infusion is attended with the least danger. The late Prof. J. M. Maisch prepared a fluid extract of arnica, which has been found very useful as an application for the *bites* of mosquitoes and other insects, thus: Exhaust powdered arnica flowers, 1 pound, with diluted alcohol; filter; evaporate to the consistence of an extract, and redissolve this in 2 pints of ordinary alcohol. By adding 4 ounces of this fluid extract to 1 pint of glycerin, placing the mixture on a water-bath, so as to expel the alcohol, an elegant *glycerole of arnica* may be made; it may be made stronger if desired. This may be used in all cases where the local action of arnica is desired.

Dose of the powder, 5 to 10 grains, 2 to 4 times a day; of the infusion, made by adding $\frac{1}{2}$ ounce of the flowers to 1 pint of water, from $\frac{1}{2}$ fluid ounce to 1 fluid ounce; of the extract, which is an excellent form of administration, from 1 to 10 grains, 4 or 5 times a day. Of specific arnica, from 1 to 10 minims. In preparing an infusion of the flowers they should be loosely tied in a bag in order to prevent the down or fine fibers from getting into the infusion, or else they will cause troublesome irritation of the throat, nausea, and vomiting.

Specific Indications and Uses.—Muscular soreness and pain from strains or over-exertion; advanced stage of disease, with marked enfeeblement, weak circulation, and impaired spinal innervation; embarrassed respiration; lack of control over urine and feces; sleeplessness from impeded respiration, and dull precordial pain from "heart-strain;" muscular pain and soreness when the limbs are moved; tensive backache, as if bruised or strained; cystitis, with bruised feeling in bladder, or from a fall or blow; headache, with tensive, bruised feeling and pain on movement; hematuria, with dull, aching lumbar pain, or from over-exertion. All cases of debility with enfeebled circulation.

Related Species.—*Arnica foliosa*, Nuttall. Northern and western United States, as far south as Colorado, growing in the mountain districts. This and the following species have flowers which resemble very much those of *Arnica montana*.

Arnica alpina, Olin, United States. Distribution same as *A. foliosa*.

Arnica nudicaulis, Elliott (*Arnica Claytonia*, Pursh). United States, from Virginia to Florida, growing in damp, pine barrens and wet sands. Flowers in April and May.

Arnica mollis, W. J. Hooker (*Arnica lanceolata*, Nuttall; *Arnica Chamissonis*, Lessing.) Mountainous regions of northern states, especially in New York and New Hampshire. Blooms in July. This and the preceding species are thought to have properties resembling those of *Arnica montana*.

ARSENI IODIDUM (U. S. P.)—ARSENIC IODIDE.

FORMULA: AsI_3. MOLECULAR WEIGHT: 454.49.

SYNONYMS: *Arsenous iodide, Iodide of arsenic, Arsenii iodidum, Arsenicum jodatum, Arsenum jodatum, Arsenici iodidum, Ioduretum arseniosum.*

Preparation.—Sixty (60) parts of pure, powdered, metallic arsenic are mixed with three hundred (300) parts of iodine, and the mixture fused in a flask. The operation must be performed under a flue, with a good current of air, and the operator must avoid inhalation of the fumes. The foregoing method is in accordance with the *U. S. P.*, 1880. Arsenic iodide forms an orange-red volatile, crystalline solid, which is dissolved by cold water, and is a powerful preparation, combining the effects of arsenous acid and iodine, and requiring great caution in its use.

Description and Tests.—The Pharmacopœia directs: "Glossy, orange-red, crystalline masses, or shining, orange-red, crystalline scales, having an iodine-like odor and taste, and gradually losing iodine on exposure to air and light. Soluble at 15° C. (59° F.) in 7 parts of water and in about 30 parts of alcohol; also soluble in ether and in carbon disulphide. The salt is gradually decomposed by boiling water and by boiling alcohol. By heat it is completely volatilized; and if it be heated with diluted nitric acid, vapor of iodine will be evolved. The aqueous solution of the salt has a yellow color, is neutral to litmus paper, and, on standing, gradually decomposes into arsenous and hydriodic acids. On adding hydrogen sulphide T.S. to the solution acidulated with hydrochloric acid, a lemon-yellow precipitate is produced"—(*U. S. P.*). If prepared by fusion, orange-red masses result, while the crystalline scales are produced by sublimation or by crystallization. "Arsenic iodide should be kept in glass-stoppered vials, in a cool place, protected from light"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—In small doses this agent is alterative; in excessive doses an irritant poison like arsenic. The symptoms from small doses are dryness of the throat and intestinal canal, perspiration, and headache. Gastric derangement and faucial dryness are signals to stop its administration. Said to be useful in *secondary syphilis*, *lupus*, *lepra*, and other obstinate affections of the skin, with dry, burning, itching, and scaly eruptions, or scrofulous enlargement of the glands (Webster). Like arsenic it undoubtedly retards the development of *scirrhus of the breast* in debilitated individuals. Internally its dose is $\frac{1}{20}$ grain, 3 times a day, in form of pill, gradually increasing to $\frac{1}{3}$ grain. Biett's ointment for cutaneous diseases is made of 1 part of the iodide to 192 parts of lard, of which 1 drachm may be used at a time. The solution may be made extemporaneously by mixing together 1 part of compound solution of iodine and 4 parts of Fowler's solution, of which the dose is from 3 to 6 drops.

In epidemical hot weather *diarrhœa* of children, and in the *marasmus* following prolonged *cholera infantum*, the 6 x trituration, in 2 or 3-grain doses, every 2 hours, is recommended by Webster. *Hay fever*, and old fetid and bleeding *nasal catarrh*, extending to the throat, is treated with the 3 x trituration by Hale.

Specific Indications and Uses.—"Chronic eczema, dyspepsia, feeble nutrition, weakness, debility, profuse, acrid, nasal discharge, causing erosion where it comes in contact with the skin. Three to 5 grains, third trituration, 3 times a day" (Watkin's *Comp. of Ec. Med.*).

Arsenic and Its Compounds.—Arsenum, *Arsenium*, *Arsenicum*, *Arsenic*. Symbol: As. Atomic Weight: 74.9. Specific gravity, 5.73 to 5.96. This is a metallic substance of bluish-white color, not unlike that of steel, with a great deal of brilliancy. It is odorless, but when heated emits a strong odor of garlic. It is the softest of all the metallic bodies, and is very brittle and easily reduced to powder. At 180° C. (356° F.) it sublimes without melting. It may be kept under water without alteration; but when exposed to the air it soon loses its luster, and often becomes black and falls into powder. It combines with oxygen in two proportions, forming compounds which possess acid properties; namely, *arsenous acid* and *arsenic acid*, both combining with bases, forming *arsenites* in the former, and *arsenates* in the latter case.

Arsenic exists free in small amounts, but is most abundant as arsenide of iron, nickel, or cobalt, and still more plentiful in the arsenic sulphides—*realgar* (As_2S_2) and *orpiment* (As_2S_3). It exists in large amounts in arsenical pyrites, or *mispickel* ($FeS_2.FeAs_2$). *Native arsenic* uncombined is often known as flystone (*cobaltum*). *Cobalt-glance* has the composition, $CoS_2.CoAs_2$, and *tin-white cobalt*, $CoAs_2$. From these ores, especially arsenical pyrites, metallic arsenic is obtained by sublimation and purified by resublimation with the addition of some powdered charcoal.

Arsine, *Hydrogen arsenide* (AsH_3), *Arseniuretted hydrogen.*—This colorless, poisonous gas is produced when arsenic or arsenous acids or oxides, or their salts, are acted upon by hydrogen in a nascent condition. It is familiar as the gas generated in applying *Marsh's Test for Arsenic* (see *Acidum Arsenosum*). This gas has a strong odor of garlic, and when ignited burns with a bluish flame, evolving white, cloud-like vapors of arsenous oxide, at the same time liberating water. If, however, a cold plate of porcelain be held in the flame close to the orifice of the emission tube metallic arsenic will be deposited upon it as a mirror-like film. Glass or a plate may be used for the same test. Arseniuretted hydrogen has a specific gravity of 2.695.

Realgar, *Red orpiment*, *Disulphide of arsenic* (As_2S_2).—This mineral sulphide of arsenic occurs in beautiful scales of an orange-red color. It is volatilized by heat. It may be artificially prepared by melting together 3 parts of sulphur and 5 parts of arsenic, when sulphur dioxide will be evolved. If ignited it produces a blue flame. A pyrotechnic mixture may be made of 2 parts of red orpiment, 7 parts of sulphur, and 25 parts of potassium nitrate, the latter, when mixed with red orpiment, causing it to give a white flame. This preparation is also used for signaling. It has been used as a pigment.

Orpiment, *Auripigmentum*, *Trisulphide*, or *Yellow sulphide of arsenic* (As_2S_2), crystallizes in monoclinic prisms of yellow color, and is the same substance as that obtained artificially when a solution of arsenous acid in water, acidulated with hydrochloric acid, is precipitated by hydrogen sulphide gas. It has been used as a pigment under the name of *King's yellow*, but its use is now abandoned, owing to its poisonous properties, as it contains a large percentage of arsenous acid. It is prepared commercially by subliming a mixture of 7 parts of powdered arsenic trioxide and 1 part of sulphur. Chrome yellow is now used in its stead (R. and S.). Mixed with a large quantity of slaked lime it acts as a depilatory. It is chiefly used in making pyrotechnic mixtures.

Arsenous Bromide ($AsBr_3$).—This salt is produced by the union of arsenic and bromine through the intervention of carbon disulphide. It is a deliquescent, crystalline body, devoid of color, and has a distinctive and peculiar odor. It fuses at near 20° C. (68° F), and begins to boil at 202° C. (428° F.). Its density is 3.86. In contact with water it is decomposed, producing bromide of hydrogen and trisulphide of arsenic. This remedy was employed in solution by Clemens for the treatment of *diabetes*.

Specific indications and uses.—"Choreic tendencies, asthma, anemia, soft, flabby skin. Ten to 20 drops (solution) in 4 fluid ounces of water; teaspoonful 3 times a day" (Watkin's *Comp. of Ec. Med.*).

Arsenous Chloride ($AsCl_3$).—An intensely poisonous, oily fluid, without color, produced by heating together and distilling arsenous acid and hydrochloric acid. It is volatile, and when dissolved in water is at once resolved into the acids used in preparing it, namely, arsenous and hydrochloric acids. Its boiling point is 134° C. (273.2° F.); its density, 2.205.

Arsenic Oxide (As_2O_5), *Arsenic pentoxide*, *Anhydrous arsenic acid.*—If arsenous acid be heated with an aqueous solution of nitric acid, arsenic acid (AsO_4H_3) is produced. If this solution be evaporated, and the residue heated to 100° C. (212° F.), *ortho-arsenic acid* (AsO_4H_3) is left. It occurs as a white, heavy, solid mass, which, by its deliquescence, is converted into a corrosive, oily-appearing fluid, really arsenic acid, in concentrated solution. Ortho-arsenic acid (AsO_4H_3), heated to a temperature of 180° C. (356° F.), loses water and forms *pyro-arsenic acid* ($As_2O_7H_4$). Upon further heating to a temperature of 200° C. (392° F.), water is again given off, resulting in the formation of *meta-arsenic acid* ($AsO_3H.$), a crystalline mass. In this respect the analogy between arsenic and phosphorus is evident. Unlike phosphorus, however, meta-arsenic acid, upon further heating to a temperature just below red-heat, again loses water and forms arsenic pentoxide. This, when subjected to a red heat, gives off oxygen and leaves arsenous oxide (As_2O_3). Water changes it into arsenic acid. *Meta-arsenic* and *pyro-arsenic acids* may also be converted into arsenic (ortho-arsenic) acid when brought in contact with water. This compound, while poisonous, is less so than the lower oxide. It, as well as arsenic acid, is consumed considerably, chiefly as an oxidizing chemical in the production of aniline red (see *Aniline Dyes*). Arsenic acid forms salts (arsenates) corresponding with those of phosphoric acid.

ARUM.—INDIAN TURNIP.

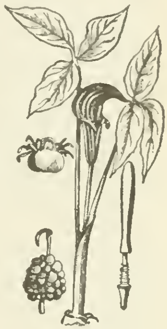
The partially dried corm of the *Arisæma triphyllum*, Torrey (*Arum triphyllum*, Linné).

Nat. Ord.—Araceæ.

COMMON NAMES: *Indian turnip, Jack-in-the-pulpit, Dragon-root, Wake-robin.*

ILLUSTRATIONS: Willdenow, *Sp. Plant* IV, 480, as *Arum triphyllum;* also as same in Bigelow, *Amer. Med. Bot.* I, 52; Johnson's *Med. Bot. of N. A.*, 263.

Fig. 30.



Arisæma triphyllum.

Botanical Source.—Indian turnip has a round, flattened, perennial, rhizome (cormus), the upper part of which is tunicated like the onion, the lower and larger portion tuberous and fleshy, giving off numerous long, white radicles in a circle, from its upper edge; the under side is covered with a dark, loose, wrinkled epidermis. The spathe is ovate, acuminate, convoluted into a tube at the bottom, flattened and bent over at the top like a hood, varying in color internally, being green, dark-purple, black, or variegated with pale-greenish stripes on a dark ground, supported by an erect, round, green, purple, or variegated scape, invested at the base by the petioles and their acute sheaths. The spadix, situated within the spathe, is club-shaped, shorter than the spathe, rounded at the end, green, purple, black, or variegated, contracted into a narrow neck at the base, where it is surrounded by the stamens or ovaries. In the fertile plants it is invested with roundish, crowded ovaries, each tipped with a stigma; in the barren its base is covered with conical, fleshy filaments, each bearing from 2 to 4 circular anthers. Plants which are perfectly monœcious, and which are the least common, have stamens below the ovaries. The upper portions of the spadix wither, together with the spathe, while the ovaries grow into a large, dense bunch of shining berries of a bright scarlet color. The leaves, generally one or two, are ternate and stand on long, sheathing footstalks. The leaflets are oval, mostly entire, acuminate, smooth, paler on the under side; becoming glaucous as the plant grows, the two lateral ones being somewhat rhomboidal.

Description and History.—The corm is subglobular, depressed, or turnip-shaped, from 1⅔ to 2½ inches in diameter. The base is free, flat and corrugated, while the upper portion has a zone of rootlets surrounding the corm. Within it is milky-white, amylaceous, or mealy, while externally it is of a dark, brownish-gray color. It has no odor, and possesses an acrid, burning taste. When first dug it is fiercely acrid—too much so for internal employment; upon masticating it, it causes a persistent and intensely acrid impression upon the tongue, lips, and fauces, like that of a severe scald, with considerable prickling, and which is followed by slight inflammation and tenderness. Milk relieves this sensation, greatly modifying its intensity. It exerts no such influence upon the external skin, except upon long and continued application. The ordinary solvents, ether perhaps excepted, do not extract the acrid element, which is exceedingly volatile, the root rapidly losing its acrimony by age. It should always be used when partially dried. Its activity may be preserved for a year or more by burying the root in sand. This plant inhabits the American continent, in both hemispheres, being found in wet locations, and flowers from May to July. The whole plant is acrid, but the root is the only part employed.

Chemical Composition.—In addition to its acrid principle it contains a large proportion of starch; also, gum, albumen, saccharine matter, calcium and potassium salts, and extractive. When the acrid property is driven off by heat, the root yields a pure, delicate, amylaceous matter, resembling the finest arrowroot, very white and nutritive. That raphides of oxalate of calcium give to the corm its acridity has been asserted by Weber (1891).

Action, Medical Uses, and Dosage.—(For action of the fresh root see above.) Acrid, expectorant, and diaphoretic. Recommended in *flatulence*, *croup*, *whooping-cough*, *stomatitis*, *asthma*, *chronic laryngitis*, *bronchitis*, *pains in the chest*, *colic*, *low stage of typhus*, and various affections connected with a cachectic state of the system. Externally it has been used in *scrofulous tumors*, *tinea capitis*, and other *cutaneous diseases*. Its action in the prostration of low fevers with wild delirium is due to its effects upon the cerebral centers. It is reputed useful in *cerebro-spinal fever* and *scarlatina*, when delirium is present, when the tongue is swollen, red, and painful, and the buccal membranes inflamed. *Chronic laryngitis*, or *minister's sore throat*, with sudden hoarseness and aphonia, is specifically influenced by arum. It is also useful in *ulceration of the larynx and pharynx*. It is a good remedy, internally and locally, for aggravated red *sore throat*. The powdered root may be given in 10-grain doses, increased, if required, to 20 or 30 grains, and repeated every 3 or 4 hours. It may be taken in sweetened mucilage, syrup, or honey. Specific arum, $\frac{1}{10}$ to 10 drops. Its specific effects are best obtained by minute doses of the specific arum —$\frac{1}{10}$ to $\frac{1}{2}$ drop doses.

Specific Indications and Uses.—Hoarseness and aphonia, with burning and constriction of the throat, and thin, ichorous, nasal discharge; intensely sore throat, with bleeding and fetor; a feeling of fullness or swelling of the mouth, throat, and tongue, the latter being red and sensitive.

Related Species.—*Arum maculatum*, Linné, *Cuckoo-pint.*—Europe. This plant is somewhat similar to Indian turnip, possessing the same chemical components, with the addition thereto of saponin, fixed oil, and resin. Large doses of it have produced inflammation of the bucco-œsophageo-gastric tract, and fatal effects are recorded from its use. In times of famine the peasants have used the prepared corm in making bread. Small amounts of a starchy material were at one time prepared from it on the Isle of Portland, England, and sold on the market as "*Portland sago*" or "*Portland arrowroot.*" It was formerly official in the *Dublin Pharmacopœia.*

Colocasia antiquorum, Schott. (*Arum Colocasia* [*esculentum*], Linné. *Caladium acre*, Robert Brown. *Caladium esculentum*, Ventenat). The Fijian "*Taro.*" This plant is cultivated in the Levant for its leaves, which are eaten like spinach (*Treasury of Botany*). The root well cooked is eaten by the Fijis. They call it *taro* and prefer to eat it cold. The whites prefer it roasted and served hot. These roots are largely used in Japan for food, having been catalogued in a Japanese exhibit in London as "Japanese potatoes" (Maiden, *Nat. Plants of Australia*). Styptic and astringent. Tubers used in India as fomentations in *rheumatism*. A single application of the juice of a slightly roasted petiole checks *otorrhœa* in children (Dymock, *Mat. Med. Western India*). The same arrests arterial *hemorrhage* (*Pharm. India*). Cultivated in gardens in the United States for decorative effects.

Colocasia macrorrhiza, Schott. Tubers baked or roasted in cakes called *hakkin*, and used as food by the Queensland natives.

Typhonium Brownii, Schott. (*Arum orixense*, Robert Brown). New South Wales to North Australia. Used as food like the *Colocasia macrorrhiza.*

Richardia æthiopica, Kunth. (*Calla æthiopica*, Linné.) *Egyptian calla.* The starchy tuber of this ornamental plant has been used as food.

Rhaphidophora vitiensis, Seemann. Nat. Ord.: *Araceæ.* Fiji Islands. Source of *Tonga*, which is a mixture of leaves, bark, and fibrous wood sent to market tied up with cocoanut fiber. The stem of the tree is scraped to obtain the drug. It contains starch, raphides, potassium chloride, and *tongine*, a volatile alkaloid. Introduced by Ringer and Murrell as a remedy for *neuralgia*. The bark in the above mixture comes from a tree of another order (Verbenaceæ) —the *Premna taitensis*, De Candolle. It contains fat, volatile oil, sugar, and pectin (Gerard).

ASAFŒTIDA (U. S. P.)—ASAFŒTIDA.

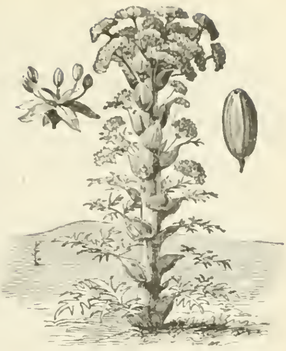
"A gum-resin obtained from the root of *Ferula fœtida* (Bunge), Regel"—(*U. S. P.*). (*Ferula Narthex*, Boissier; *Scorodosma fœtida*, Bunge; *Ferula asafœtida*, Linné; *Narthex asafœtida*, Falconer; *Ferula Scorodosma*, Bentley and Trimen).

Nat. Ord.—Umbelliferæ.

Illustration: Bentley and Trimen, *Med. Plants*, 127.

Botanical Source.—This plant has a perennial fusiform root, several inches in diameter, with a coarse, hairy summit, either simple like a parsnip, or with

Fig. 31.



Ferula fœtida, Bunge (Narthex assafœtida, Falconer).

one or more forks; its bark is wrinkled, blackish; its internal structure fleshy and white, containing a large amount of a thick, milky, fetid, alliaceous juice. The leaves are radical, springing up in the autumn, growing vigorously during the winter, withering at the close of spring. They are several in number, 1½ feet long, shining, coriaceous like those of lovage, glaucous-green, pinnated, with pinnatifid segments whose lobes are oblong and obtuse; the petioles terete, and channeled only at the base. The stem is herbaceous, 8 or 10 feet high, and about 6 inches in circumference at the base; it is solid, smooth, and clothed with membraneous sheaths. The general umbels have from 10 to 20 rays; the partial ones 5 or 6 flowers. The flowers are pale-yellow, succeeded by a flat, thin, reddish-brown fruit, like that of parsnip, only rather larger and darker, and slightly hairy or rough. The plant varies somewhat owing to its location and the character of the ground (L.—Falconer—Royle).

History.—This plant is indigenous to Persia and Thibet. It was personally examined and imperfectly delineated by Kæmpfer, in 1687. According to Polak it is principally gathered in the country from Ispahan to Mahior, and that part which separates Abedeh and Murgab, and is much used as a culinary article, and to remove spasm. In several provinces it is planted in gardens to keep away destructive insects. The gum-resin is obtained by incisions into the upper part of the root, or by slicing it successively in small pieces; plants under four years are not made use of, as they yield but little, if any, of the juice. When the leaves begin to decay, the root-leaves and stem are twisted off close to the root, and the soil is removed from its crown. About 40 days afterward a thin slice is cut off transversely from its top, and a milky juice of a fetid, alliaceous odor gradually exudes. In about two days, or when this exudation has become hardened, it is scraped off, and another thin slice removed as before, from which juice again flows, and this process is repeated until no more juice can be obtained; while this collection is going on the root is constantly protected from the solar rays. The concrete juice from several plants are then put together, further hardened, and disposed of for home use or foreign exportation. Most of the gum used in medicine comes from Afghanistan and Persia. The purest gum is known by the vernacular, *hing*. According to Dymock the brown asafœtida is produced by the *Ferula alliacea*, Boissier. The product principally found in our markets is that shipped from Bombay and known as *hingra*, a product largely admixed with stones and dirt. Dymock states that sliced potatoes have been used to adulterate asafœtida.

Description.—This gum-resin is brought to America in packages of various weights, but seldom less than 50 or 60 pounds each. The *U. S. P.* describes it as occurring "in irregular masses composed of whitish tears, which are imbedded in a yellowish-gray or brownish-gray, sticky mass. The tears, when hard, break with a conchoidal fracture, showing a milk-white color, which changes gradually, on exposure, to pink, and finally to brown. It has a persistent, alliaceous odor, and a bitter, alliaceous, acrid taste. When triturated with water it yields a milk-white emulsion, which becomes yellow on the addition of ammonia water. It is partly soluble in ether, and at least 60 per cent of it should dissolve in alcohol"—(*U. S. P.*). Those masses should be selected which are clear, of a pale, reddish color, and variegated with a great number of white tears, and on burning they should not have an odor of pitch. Berzelius and Thomson give as its specific gravity, 1.327. Age hardens it and impairs its properties; it becomes pulverable at a diminished temperature, as in frosty weather; in warm weather it becomes soft and adheres to the pestle. Moderate heat softens it so far that it may be squeezed through a coarse cloth, and freed from impurities of a mechanical nature; a stronger heat causes it to froth, and at a red heat it burns with a white flame.

Rubbed with cold or warm water, the gum is dissolved, forming a smooth white or reddish, persistent emulsion, in which the resin and volatile oil are suspended. With rectified alcohol, which is its best menstruum, it forms a clear, yellowish-red tincture. Spirit dissolves the resin and oil, but is too feeble a solvent. Sulphuric ether dissolves the volatile oil and a portion of resin; solution of caustic potash dissolves it almost entirely, forming an emulsion when the alkali is neutralized; and solution of ammonia dissolves the gum and oil, with part of the resin. It readily unites with other resins, gum-resins, and wax; and is best preserved in bladders kept in tin boxes.

Chemical Composition.—Asafœtida contains volatile oil, resin soluble in ether, a tasteless resin insoluble in ether, various gums, sulphate of calcium, carbonate of calcium, oxide of iron, and alumina, malate of calcium, etc. The volatile oil may be obtained by distillation with water or alcohol; at first it is pale-green, but becomes yellowish-brown by age, is lighter than water, of a powerfully offensive odor, and a taste peculiar to the gum-resin; it contains sulphur (Zeise). In odor it closely resembles that of the persulphide of allyl, procured from oil of mustard. According to Schimmel & Co. (*Semi-Annual Report*, October, 1893) the gum-resin yields from 3.3 to 3.7 per cent of oil, having a specific gravity of 0.985, at 15° C. (59° F.), and an optical rotation of —9° 15′; and according to Semmler's investigations (1891) it contains a terpene, probably *pinene;* also the sulphurous combinations, $C_{10}H_{14}S_2$ and $C_{11}H_{20}S_2$, and, beside other compounds, a body having the formula $(C_{10}H_{16}O)_n$. Fractionally distilled the volatile oil yields, at 300° C. (572° F.), a beautiful blue oil (*Pharmacographia*). The oil and the bitter resin are the active principles. The resin is but partially soluble in ether and is soluble in alcohol. It contains *ferulaic acid* ($C_{10}H_{10}O_4$), a substance crystallizing in iridescent, acicular crystals, having neither taste nor odor. The resin fused with alkali yields resorcin ($C_6H_6O_2$). A body named *umbelliferon* ($C_9H_6O_3$), as well as oils of various colors, may be obtained by dry distillation of the resin. Acetic, formic, malic, and valerianic acids have also been found in asafœtida. Sulphate of calcium has been found as an adulteration of this gum-resin, occurring in commercial samples sometimes to the extent of 50 per cent. The *U. S. P.* requirement (60 per cent soluble in alcohol) is not reached by asafœtida of commerce. Were the standard made 40 per cent, the drug would better conform to requirements (J. U. Lloyd in *Pharm. Review*, 1896).

Action, Medical Uses, and Dosage.—The odor of asafœtida is imparted to the breath, secretions, flatus, and gastric eructations. Its properties are stimulant, antispasmodic, expectorant, emmenagogue, and vermifuge (*Ed.*). Improper in inflammatory conditions of the system, but of marked value in purely functional nervous disorders, with excitability, and as a gastric stimulant in *gastro-intestinal atony*, with flatulence. It allays *gastric irritation*. Used in *croup*, *pertussis*, *hysteria*, *infantile convulsions*, *flatulent colic*, *chronic catarrh*, *chlorosis*, *spasmodic nervous diseases* of females, and, in combination with morphine and quinine, in *sick* or *nervous headache*. With resin of podophyllum and resin of cimicifuga, it is beneficial in *chorea*. Likewise efficient in *amenorrhœa* and *dysmenorrhœa*, and as an injection in *tympanitic abdomen*, *lumbricus*, and *ascarides*. In *hysteria* its effects are especially good, sometimes preventing the attack if given early, or if the disorder be already developed it tends to modify its force. In the tympanitic states of the bowels during *fevers*, or when only constipation exists, it is a prompt remedy. As an antispasmodic it holds a secondary place, probably acting best in those disorders arising from a disordered stomach. Minute doses are asserted to increase the mammary secretion. As a remedy for *bronchial cough*, dry, deep-seated and stubborn, a 2-grain pill every 3 hours will give quite positive results. Asafœtida is best adapted to cases exhibiting nervous depression, with more or less feebleness, and particularly if associated with gastric derangements with constipation, flatulence, and tardy or imperfect menstruation. Dose, in powder or pill, from 5 to 10 or 20 grains; of the tincture, from 30 drops to 2 fluid drachms. Asafœtida is also employed alone, or in combination, in the form of a suppository, or an enema.

Specific Indications and Uses.—Nervous irritation, with mental depression, headache, and dizziness; hysteroidal conditions; convulsive disorders from purely functional wrongs of the stomach, gastro-intestinal irritation, with flatulence and palpitation of the heart; dry, deep, choking, bronchial cough.

ASARUM.—WILD GINGER.

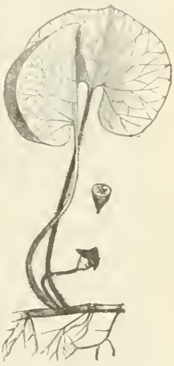
The rhizome and rootlets of the *Asarum canadense*, Linné.

Nat. Ord.—Aristolochiaceæ.

COMMON NAMES: *Wild ginger, Indian ginger, Canada snakeroot*, and (improperly) *Coltsfoot*.

Botanical Source.—This American plant closely resembles the asarabacca of Europe (*A Europæum*). It has a creeping, fleshy, somewhat jointed, yellowish rhizome, with rootlets. From it ascends a quite short stem, which is forked near the surface of the soil, and each branch bears a reniform leaf, downy on both sides, 3 or 4 inches by 3 or 5, the petiole of which is long, round, and hairy. Upon a pendulous, hairy peduncle, growing from the fork of the stem, is a solitary flower, having a very wooly calyx, consisting of 3 broad, concave, pointed leaflets, of a brownish, dull-purple or greenish color on the inside, at top and bottom, depending on the amount of light which the plant enjoys, terminated by a long, spreading, inflected point, with reflect sides. The corolla is wanting. The fruit is a coriaceous, 6-celled capsule.

Fig. 32



Asarum canadense.

Description.—Wild ginger occurs in commerce in irregularly 4-angled pieces, about 3 to 5 inches in length, and about ½ inch in diameter. They are crooked, ash-brown, or purple-brown in color, break with a short fracture, are pulverable, and whitish internally. About every half inch exhibits nodes, to which thin rootlets are attached. The inner structure is pithy, surrounded by a broken zone of woody fibers, all enclosed in thick bark, which contains oil cells. The rootlets are traversed by a ligneous, central portion, covered with thick bark. It is fragrant, spicy, and slightly bitter.

History.—Wild ginger is a native of the United States, growing in woods and mountains, and in rich soil along roadsides, flowering in May and June. The whole herb has a fragrant odor, and a spicy, amarous taste. The root is the part used, and yields its active principles to alcohol, and partially to water by infusion. The oil is now used in the making of perfumes, and in various toilet waters.

Chemical Composition.—Asarum contains an acrid, bitter, reddish resin, a pale, spicy, aromatic, volatile oil, gum, chlorophyll, fat, starch, and various salts. It probably, also, contains an alkaloid, as Power obtained a body in very small quantities, which reacted with alkaloid-group reagents. The coloring matter (yellow), as Prof. Power has shown, appears to be the same as the *asarin* found by Graeger in asarabacca. The oil consists of *asarene* ($C_{10}H_{16}$), a neutral principle, *asarin* ($C_{12}H_{16}O_2$), *asarol* ($C_{10}H_{18}O$), and ethers of asarol—probably the acetic and valerianic—and is thought also to contain *methyl-eugenol*, a substance hitherto not observed in nature.

Action, Medical Uses, and Dosage.—Asarum canadense is a spicy, stimulating agent, causing perspiration, promoting expectoration, and possessing carminative properties. It may be advantageously added to tinctures and compounds to improve their flavor, and render them more stimulating. It is used in *colic* and other *painful affections* of the stomach and bowels where no inflammation exists, and in *chronic pulmonary affections*. It has been successfully used by Dr. J. R. Black in *dropsy*, with albumen in the urine. The warm infusion is an excellent agent to promote copious sweating, and may be substituted for Virginia snakeroot as a diaphoretic and in *debility*. Harsh, dry skin, with checked perspiration, in low *febrile* and *inflammatory affections*, not of the gastro-intestinal tract, and sudden *colds*, have been successfully treated with the warm infusion, which is also a prompt emmenagogue when *amenorrhœa* is due to recent colds Dose of the powder, ½ drachm; of the tincture, ½ fluid drachm to 2 fluid drachms. Of the infusion (℥ss to aqua Oj), freely; used also as an errhine.

ASARUM EUROPÆUM.—ASARABACCA.

The rhizome and leaves of the *Asarum Europæum*, Linné.

Nat. Ord.—Aristolochiaceæ.

Common Names: *Asarabacca, Hazlewort, Wild nard.*

Botanical Source.—This plant has a creeping root or rhizome, entangled with numerous stout, branching fibers. The stems are very short, simple, round, herbaceous, pubescent, each bearing 2 dark-green, shining, reniform, obtuse, entire, somewhat downy leaves, which are opposite, 2 inches wide, on long, downy, footstalks; also, 1 drooping flower, not an inch long, fleshy, of a dusky-purple color, placed upon a short terminal peduncle. The calyx is campanulate, greenish at the base, divided into 3-pointed, purplish segments, which are erect and turned inward at their extremity. The corolla wanting. The fruit is a 6-celled, coriaceous capsule, crowned with the persistent calyx.

Description and History.—The root is ash-colored, 2 or 3 lines in thickness, 4-angled, contorted, rough; has a pepper-like odor, a biting, spicy taste, and yields an ash-colored powder. Its properties are taken up by water or alcohol; boiling evaporates and age impairs them. The leaves have virtues similar to those of the root; they have a very feeble odor, a taste like that of the root, with some bitterness, and produce a green powder, having a yellow tinge. Asarabacca is a European plant, growing in moist, hilly woods, and presenting a single, bell-shaped, dingy-brownish-red flower from May to August. The root and leaves are used in medicine, and when recent are quite acrid. They should always be carefully dried for preservation.

Chemical Composition.—Græger has found in the root volatile oil, *asarum camphor* ($C_{20}H_{26}O_5$) (*asaron*), *asarit*, *asarin*, tannic acid, resin, starch, extractive, gluten, albumen, various salts, etc.; in the herb, *asarin*, tannic acid, extractive, citric acid, chlorophyll, etc. (P.). The substances designated by Græger as *asarum camphor* and *asarit*, were subsequently shown to be identical in chemical composition, differing only in their physical properties, the former being at first an oily liquid, which afterwards crystallizes in scale or needles from an aqueous distillate, and the latter acicular crystals, precipitated from the same. *Asarin*, a yellow body, gives to this drug its bitterness. It is probably identical with the *cytisin* of Lassaigne and Fenuelle. The yield of oil is about 1.0 per cent. It has an odor resembling valerian, is yellow, viscid, and has a pungent, burning taste. According to Schimmel & Co. (*Semi-Annual Report*, October, 1893), its specific gravity, at 15° C. (59° F.), ranges from 1.046 to 1.068, and its known constituents are *asarone*, *pinene*, and *eugenol-methyl-ether*. The chemistry of asarone was investigated in detail by Rizza and Butlerow, in 1884 and 1888.

Action, Medical Uses, and Dosage.—Asarabacca produces nasal irritation, followed by free secretions, which flow persistently. It is emetic, cathartic, and errhine. Used principally as an errhine in certain affections of the brain, eyes, face, and throat, *toothache*, *ophthalmia*, and *paralysis of the mouth and tongue*. Internally it is a stimulant in doses of 10 or 12 grains; and an emetic in ½ drachm or 1 drachm doses. It is said to be used in France by drunkards to produce vomiting.

Related Species.—*Asarum Sieboldii*, Miquel. This plant is the *to-sai-shin* of the Japanese. The rhizome is slender, stem-scarred, and has attached to it thick, tufty aggregations of long, light-brown rootlets. These are white and mealy internally, surrounding a yellow, woody cord. It has an aromatic fragrance, and the taste resembles the combined flavors of sassafras and nutmegs, followed by an irritating pungency. It grows in Japan.

ASCLEPIAS (U. S. P.)—ASCLEPIAS.

The root of *Asclepias tuberosa*, Linné"—(*U. S. P.*).

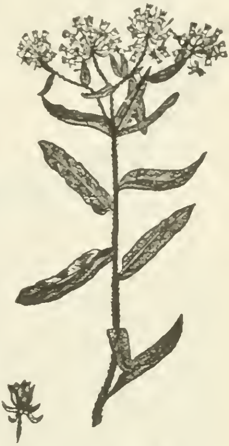
Nat. Ord.—Asclepiadeæ.

Common Names: *Pleurisy root, Butterfly weed, Orange swallowwort, Wind root, Tuber root.*

Illustrations: Bigelow, *Am. Med. Bot.* II, 59; Barton, *Med. Bot.* I, 239.

Botanical Source.—Asclepias has a perennial, large, fleshy, branching, white, and sometimes fusiform-like root, from which numerous stems arise, growing from 1 to 3 feet high; these are erect, or more or less procumbent, round, hairy, green or red, growing in bunches from the root. The leaves are alternate, the lower ones pedunculated, the upper sessile. They vary from linear to oblong-lanceolate, are hairy, dark-green above, paler beneath, waved on the edge, and in the old plants sometimes revolute. The flowers are numerous, erect, of a beautifully bright orange color, and are arranged in terminal, rarely axillary, umbels, which are corymbose.

Fig. 33.



Asclepias tuberosa.

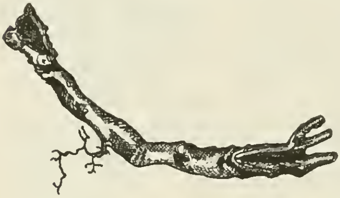
History.—Many of the asclepiadeæ have, from time to time, furnished the medical profession with important medicines. The order is largely represented in the tropics, but the North American genera are comparatively few. The most important plant bearing the name asclepias (derived from Æsculapius), to Eclectics at least, is the *Asclepias tuberosa*, or butterfly weed. It is perhaps best known to the profession, at least to the older physicians, as *pleurisy root*, a name indicating one of its most important applications. Though growing most abundantly in the South, it may be found as far north as Massachusetts, preferring gravelly and sandy soils. It blooms in June, July, and August, and when in flower forms one of the most conspicuous and handsomest features of a summer landscape. For miles along the railways clusters of the rich, deep orange flowers of the butterfly weed, as it is called, bedeck the fields, a sight perhaps more pleasant because it blooms when the majority of showy plants are less abundant. This plant differs from its congeners in being destitute of the milky juice common to most of them, such as the common milkweed (*Asclepias Cornuti*), and others. Several popular names have been given it, indicative either of its appearance or use, the most common of which are pleurisy root, butterfly weed, orange swallow-wort, silkweed, tuber root, wind root, white root, flux root, and Canada root. The official part is the root; it is spindle-shaped, of a light-brownish color on the outer surface, white, coarse, and striped within. When fresh it has a disagreeable, slightly acrimonious taste; when dried its taste is slightly bitter. Boiling water or alcohol extracts its virtues. The infusion is undoubtedly the most effective medicinal preparation. When the infusion can not be employed specific asclepias is next preferred.

Description.—"Root large and fusiform, dried in longitudinal or transverse sections, from 2 to 15 Cc. long (¾ to 6 inches), and about 2 Cc. (¾ inch) or more in thickness; the head knotty, and slightly but distinctly annulate, the remainder longitudinally wrinkled, externally orange-brown, internally whitish; tough, and having an uneven fracture; bark thin, and in two distinct layers, the inner one whitish; wood yellowish, with large, white, medullary rays. It is inodorous, and has a bitterish, somewhat acrid taste. When long kept it acquires a gray color"—(*U. S. P.*).

Chemical Composition.—Mr. Elam Rhoads found in this root gum, pectin, starch, albumen, gallic and gallo-tannic acids, lignin, salts, an odorous material of a fatty nature, two resinous bodies—one dissolving in ether, the other refusing to so dissolve—and a fixed oil. Mr. Rhoads also obtained a peculiar body having the taste of the drug, which may be thrown down from a strong infusion of the root by tannin. By decomposing with litharge and exhausting with boiling alcohol, decolorizing and evaporating the liquid, a yellowish-white powder is obtained, which is soluble in ether, alcohol, and less freely in water, from which it may be dissociated by tannin. Sulphuric acid colors it brown and nitric acid pink, finally becoming purple (Clabaugh). The above-mentioned principle was ascertained by Quackenbush (1889) to be a glucoside, and was obtained by him in crystalline condition. He also detected a fluorescent body, but nc tannin.

Action, Medical Uses, and Dosage.—Asclepias, or pleurisy root, was one of the most common of the indigenous medicines employed by the Eclectic fathers. It was favorably written upon by most of the earlier writers on American medicinal plants. The drug has fallen into unmerited neglect, and could profitably be employed at the present day for purposes for which much more powerful, and sometimes dangerous, drugs are used. It has an extensive range of usefulness, being possessed of diaphoretic, diuretic, laxative, tonic, carminative, expectorant, and probably antispasmodic properties. Asclepias and corallorrhiza, are, *par excellence*, the diaphoretics of the Eclectic materia medica. Like crawley, it is not stimulating, and may be used to promote diaphoresis, no matter how high the degree of fever. It differs from most diaphoretics in producing a true secretion from the skin that more nearly resembles the normal function of insensible perspiration than any other agent of its class. It increases largely the elimination of solid material to the exclusion of copious perspiration. Crawley increases both the solid and liquid transpiration. Asclepias may be indicated even though the patient be freely perspiring. While the liquid flow is copious it may be deficient in power to carry off the solid detritis, an act which the asclepias will perform, provided the indications for its use are present. While it is serviceable even where the temperature is high, it does its best work where the temperature is but moderately exalted, and when the *skin is slightly moist*, or *inclined to moisture*, and where the pulse is vibratile and not too rapid. If the pulse be rapid, weak, and small aconite will assist it; if rapidly bounding and strong, veratrum should be administered at the same time. Pleurisy root has a deservedly good reputation in respiratory diseases. It acts upon the mucous membrane of the pulmonary tract, augmenting the secretions and favoring easy expectoration. Besides its action on the respiratory mucous surfaces its action upon the skin as a true diaphoretic, establishing the insensible perspiration when the skin is dry and harsh, and correcting that weakness of the skin which allows the sweat to pour out too freely, renders it of value in the *colliquative sweating of phthisis*. As its popular name indicates, pleurisy root is of much value in treating *pleuritis*. Here it will greatly assist the action of bryonia and aconite, the latter being administered in the early stage, and bryonia and asclepias in alternation later. Not only is its action on serous membranes marked, as in the preceding disorder and in *pleurodynia*, but it is very effectual in *intercostal neuralgia* and *rheumatism*, as well as in *pericardial pains*. The chief action of asclepias is to lessen arterial tension, and acute diseases are those in which it is of most value. With the indicated sedative it is one of the best known agents in the early stage of *pneumonia* and *pleuro-pneumonia*, provided always the indications alluded to are present. Some cases will yield to asclepias alone, but this is not generally the case, as the drug plays more the rôle of an assistant than a leading remedy. It is a safe drug, for while it may not act as efficiently when not indicated, it may be said to never be contraindicated, so far as expecting any harm from its use is concerned. Hyperemic states of the breathing organs seem to call for asclepias. In pneumonia, as well as in *bronchitis*, it is best adapted to the acute stage, where the lesion seems to be extensive, taking in a large area of lung parenchyma and mucous tissués. Webster believes it best adapted to control vascular disturbances in the area supplied by the bronchial arteries, and suggests that by reserving it for this place we shall lessen its liability to confusion with other appropriate remedies. It undoubtedly acts upon the general circulatory apparatus, lowering arterial tension. In the convalescing stage of pneumonia, and other respiratory lesions, when suppression of the expectoration and dyspnœa threaten, small doses at frequent intervals will correct the trouble. In *dry asthma* with fever, but lack-

Fig. 34.



Fresh root of asclepias.

ing the spasmodic element, 5-drop doses of specific asclepias will do good service. As a remedy for dry and constricted *cough* it may be given in small amounts, preceded a half hour by specific lobelia in doses of 1 or 2 drops. In *catarrhal troubles* specific asclepias, well diluted, is useful as a local remedy when used early in the disease. It, as well as euphrasia and matricaria (chamomilla), is among our best drugs for snuffles, or *acute nasal catarrh of infants.* In *phthisis* it is valuable to alleviate the distressing cough and to allay irritability of the mucous surfaces, and is not without good effects on the circulation and the stomach, through its subtonic action. It is an excellent remedy for ordinary *colds.* It is, in fact, one of our best drugs for catarrhal conditions, whether of the pulmonary or gastro-intestinal tract, especially when produced by recent colds.

Stomach troubles, particularly those of children, are often markedly benefited by small doses of specific asclepias. A weakened stomach, accompanied with nervous impairment, or with catarrhal complications, rendering digestion difficult and painful, is often toned to do its work pleasantly under the use of small doses of asclepias. *Diarrhœa* and *dysentery*, when of catarrhal character and due to cold, are benefited by alternating with other indicated remedies, from 10 to 15 drops of specific asclepias, or the infusion may be freely employed. As a remedy for gastric disorders it is well adapted to children and weak individuals. *Headache* from disordered digestion has been cured with it, and for *flatulent colic* in young children: ℞ Specific asclepias, gtt. x to xv; aqua, fl℥iv. Mix. Teaspoonful every 5 minutes. Dioscorea may also be administered with it in cases of flatus in adults and children. A pill composed of equal parts of alcoholic extracts of asclepias, aletris, and dioscorea will be found very beneficial in *flatulency, borborygmi*, and where persons are subject to *flatulent* and *bilious colic.* In some cases, especially of long standing, the addition of pulverized African ginger will much improve its efficacy. Asclepias is a remedy for *nervous irritability* of children, especially when due to gastric disturbances. The dry forms of *cutaneous affections* are benefited by it, especially where it is necessary to establish the true dermal secretions. It is likewise beneficial in this sense in those cases of *neuralgia* and *acute rheumatism*, accompanied with profuse sweating. It alters the character of the perspiration. In the *exanthematous fevers* it favors the eruptive process, and in *painful inflammations* gives some relief by its diaphoretic action. Asclepias has been used in *dropsy*, but we have better agents for that affection. It is not an active agent, yet on the whole, though apparently a feeble remedy, when indicated, it accomplishes a purpose which no other remedy in the materia medica fulfils. Dose of the powder, 20 grains to 1 drachm, 3 or 4 times a day; of a strong infusion (the best preparation), from 2 to 4 fluid ounces, 4 or 5 times a day, until perspiration is produced; specific asclepias, 1 to 60 drops; fluid extract, 1 to 60 drops.

Asclepidin, or *oleo-resin of asclepias*, is a dark, semi-liquid mass, and is prepared by evaporation or distillation of the saturated tincture in water, similar to the plan pursued for obtaining resin of cimicifuga. It was formerly used for all purposes to which the crude article is applied, in doses of from 1 to 5 grains, 3 or 4 times a day, or as indicated.

Specific Indications and Uses.—The specific indications for asclepias, according to Dr. J. M. Scudder are: "Pulse strong, vibratile; skin moist, pain acute, and seemingly dependent on motion." The skin may be hot and dry or inclined to moisture; the urine is scanty; the face flushed; vascular excitement is marked in the parts supplied by the bronchial arterioles; inflammation of serous tissues; gastro-intestinal catarrhal troubles due to recent colds.

ASCLEPIAS CORNUTI.—MILKWEED.

The root of the *Asclepias Cornuti*, Decaisne (*Asclepias syriaca*, Linné).

Nat. Ord.—Asclepiadeæ.

Common Names: *Common milkweed, Silkweed, Wild cotton.*

Botanical Source.—The common milkweed has a large, stout, simple, somewhat branched stem, growing from 2 to 5 feet high. Its leaves are ovate-elliptical, spreading, opposite, with short but distinct petioles, gradually acute, tomentose beneath. The flowers are fragrant, arranged in several axillary, subterminal, nodding, dense, globose umbels. each of 20 or more flowers. The calyx segments are lanceolate. The corolla is pale or greenish-purple, reflexed, leaving the corona, which is of nearly the same hue, quite conspicuous. But few of the flowers prove fertile, producing oblong-pointed pods or follicles covered with sharp prickles, which contain a mass of long, silky fibers with seeds attached, and which fibers have been used for beds, pillows, and in the place of fur in manufacturing hats.

Description.—This rhizome grows from 1 to 6 feet in length, and is cut into transverse pieces or slices about ¼ inch or ½ inch in diameter. The root is cylindrical, finely corrugated, tough, has a somewhat knotty appearance from stem-scars, or partially formed branches, and breaks with a short, splintered fracture. Externally it is grayish-brown; internally white. Its white bark is thick and surrounds a yellowish, porous, woody center, and contains lactiferous channels. It has scarcely any odor, but its taste is disagreeably bitter.

History and Chemical Composition.—This herb is indigenous to the United States, inhabiting rich soils, uncultivated fields, roadsides, etc., and bearing whitish-purple, or rather dull, pinkish-purple flowers from June to September. When wounded it emits a milky fluid, which contains water, wax-like fatty matter, gum, caoutchouc, sugar, various salts, etc. A crystalline, resinous substance, has been obtained from the juice of the *A. Cornuti*, to which the name of *asclepion* has been given. It is procured by boiling and then filtering the juice, and separating the *asclepion* from the filtrate by ether, from which it may be subsequently obtained by evaporation, and purified by several washings with pure ether. *Asclepion* thus obtained is a crystalline solid, without taste or smell, and is readily dissolved by spirits of turpentine, pure acetic acid, and sulphuric ether (C. List, 1849).

Tannin, gummy material, ash, and a small quantity of volatile oil were found in the root by Mr. W. L. Hinchman, in 1881, who also obtained, in an impure state, a bitter principle. A volatile principle of an acrid character is said to reside in the fresh root. Quackenbush obtained a crystalline glucoside similar to that which he obtained from pleurisy root, but failed to find tannin (*Amer. Jour. Pharm.*, 1889). Starch is present in the parenchymatous portion of the root.

Action, Medical Uses, and Dosage.—The root of this plant is tonic, diuretic, alterative, emmenagogue, purgative, and emetic; and given in large doses it is stimulant and anthelmintic. Dr. Richardson has attributed anodyne properties to it, but he must have had reference to some other plant. It has, however, recently been revived as a remedy for *muscular rheumatism*, some claiming it to be as effective as macrotys. It should be studied in this connection. It has been found useful in *amenorrhœa*, *dropsy*, *retention of urine*, *asthma*, *dyspepsia*, *cough*, *dyspnœa*, *constipation*, *primary syphilitic disease*, *worms*, *scrofulous* and *rheumatic disorders*. The action of the heart is augmented under its use. A very excellent fluid extract may be made from it as follows: To 16 troy ounces of the recently dried root, finely bruised, add 6 fluid ounces of ether and 4 fluid ounces of alcohol; form a tincture by slow percolation, and set it aside. Then thoroughly exhaust the root by percolation, with 6 fluid ounces of alcohol and a sufficient quantity of water; evaporate this last over a water-bath, add the first tincture, made with ether and alcohol, to it, and reduce by evaporation to 1 pint. An aromatic, bitter, red fluid extract is thus obtained, of which 1 fluid drachm is equal to 1 troy ounce of the crude root. The dose is from 10 drops to 1 fluid drachm; it may be taken in ginger syrup, lemon syrup, cinnamon water, or other pleasant vehicle, to cover its unpleasant taste. Dose of the powder, 10 to 20 grains; of the decoction, 2 to 4 fluid ounces; of the tincture, 10 to 60 minims.

ASCLEPIAS INCARNATA.—FLESH-COLORED ASCLEPIAS.

The root of the *Asclepias incarnata*, Linné.

Nat. Ord.—Asclepiadeæ.

Common Names: *Flesh-colored asclepias*, *Swamp milkweed*, *Swamp silkweed*, *Rose-colored silkweed*, *White Indian hemp*.

Botanical Source.—Swamp milkweed has a smooth, erect stem, with 2 downy lines above and on the branches and peduncles, branching above, about 3 or 4 feet high. The leaves are opposite, oblong-lanceolate, acute, or pointed, obtuse at the base, on short petioles, and slightly tomentose. The flowers, which are red or reddish-purple and sweet-scented, are disposed in numerous umbels, which are crowded, erect, mostly terminal, and often in opposite pairs. The hoods of the crown are entire; the horns exserted and subulate. The leaves are from 4 to 7 inches long, and from ½ inch to 1½ inches wide; the umbels are from 2 to 6, on a peduncle 2 inches long, and consist of from 10 to 20 small flowers. There is a variety of this plant, the *Asclepias incarnata* var. *pulchra*, which is more hairy, with broader and shorter petioled leaves.

History.—This herb inhabits damp and wet grounds throughout the United States, and bears red flowers in July and August. On wounding the plant a milky juice exudes. The part used is the root; it varies in thickness from 1 to 6 lines, and is of a light-yellowish or brownish color. It imparts its properties to water.

Description.—The root is about ¾ to ⅘ inch long, oblong, or unsymmetrically globular, hard, knotty, and has attached to it several rootlets 3 to 5 or more inches long. Externally the color is yellow-brown; internally nearly white. The bark is thin, surrounding a wood that is tough and white and has a thick pith. The rootlets are of a pale-brown color and composed about equally of a woody center and whitish bark. The root is nearly without odor and has a sweet, harsh, and finally amarous taste.

Chemical Composition.—The root contains starch, pectin, grape-sugar, albumen, a fixed and a volatile oil, the latter in small amount, two resins of an acrid character (J. Y. Taylor), and an unstable, amorphous, yellow glucoside, *asclepiadin*, whose physiological effects are similar to those of emetine (Gram, *Archiv. f. Exper. Path. und Pharm.* 19, page 389).

Action, Medical Uses, and Dosage.—Anthelmintic, for which purpose the powder may be used in doses of 10 to 20 grains, 3 times a day; or the decoction, 2 to 4 fluid ounces. It has been recommended in *rheumatic*, *asthmatic*, *catarrhal*, and *syphilitic affections*, and as a vermifuge. Said to produce vomiting and purging, but this is doubtful. It is undoubtedly a valuable agent, and worthy of further investigation. According to Frazer (*Birmingham Med. Review*, 1884) this agent is stomachic and a quick, powerful, and reliable diuretic. It acts upon the heart and circulatory system like foxglove, but without its gastro-intestinal disturbances. It is useful in *chronic mucous disease of the stomach* and in *erysipelatous affections*. The dose of the fluid extract, 15 to 60 minims; infusion (℥ss to aqua Oj), ½ to 1 fluid ounce; specific asclepias incarnata, 1 to 10 minims.

Specific Indications and Uses.—Chronic mucous diseases of the stomach; catarrhal discharges; leucorrhœa; entozoic affections.

Related Species.—*Asclepias curassavica*, Linné. Habitat: Central America, South America, and West Indies. *Bastard ipecacuanha*, known also in Central America as *ponchishuiz* and *cancerillo*. It is also called *Bloodweed* and *Red head*. It is a perennial herb, with red (rarely white) flowers, and its smooth, shining seed-hairs are sometimes called *Vegetable silk*. This herb yields *asclepiadin*, a glucoside soluble in alcohol, but scarcely dissolving in ether, yielding to the latter *asclepin*, a derivative of the former. Among the effects of this drug Guimerais (1881) found it to impress the cardiac muscles and to dilate the larger arteries. Large doses (root 20 to 40 grains) are emetic; smaller doses are cathartic and anthelmintic.

Calotropis gigantea, R. Brown (*Asclepias gigantea*, Willdenow). Habitat: East Indies and South India; and *Calotropis procera*, R. Brown (*Calotropis Hamiltonii*, Wight) North India, West Asia, and Africa. Shrubs yielding *Mudar-bark*, which contains a bitter principle, an acrid, resinous body, and starch, caoutchouc, and resins. A crystalline body resembling *asclepion* was found in it by Waddell. The bark has a bitter, acrid, mucilaginous taste.

Mudar-bark (3 or 4 grains) is used as an alterative and tonic in India; in larger doses (20 to 40 grains) it is emetic and diaphoretic, increasing the action of the surface capillaries and absorbents. It is employed as a substitute for ipecac in *dysentery*; also in *leprosy*, *elephantiasis*, *rheumatism*, *dropsy*, and *syphilis*. Dose, 3 to 12 grains, 3 times a day. The dry juice is said to be used in India as an abortivant and to destroy female babies.

Cynanchum Vincetoxicum, Persoon (*Vincetoxicum officinale*, Moench; *Asclepias Vincetoxicum*, Linné). Europe, where it is known as *White swallow-wort*. The root is employed, and when fresh has a valerian-like odor, which is practically dissipated on drying. It contains fat, essential oil, pectin, and *asclepin*, a resinous body shown by Gram to be a derivative of *asclepiadin*, the emetic glucoside. It is thought to be identical with the *vincetoxin* of Tanret. The bark has an acrid, sweet, and bitterish taste. Emetic, and in large amounts may induce fatal gastric inflammation. *Scrofulous* and *cutaneous disorders* have been treated with it.

ASEPSIN.—ASEPSIN.

The trade-name of a compound prepared from wintergreen oil.

FORMULA: $C_8H_7O_3Na$. MOLECULAR WEIGHT: 150.64.

History, Preparation, and Description.—Asepsin, so named by Prof. A. J. Howe as a trade-mark name, is a compound made of oil of wintergreen (*Oleum Gaultheriæ*), and introduced as a remedy under the above trade-name. This substance is a definite sodium compound of the above composition. It is a white, crystalline powder, nearly insoluble in cold alcohol, chloroform, and ether, but soluble in boiling alcohol and ether. It is perfectly and readily soluble in both cold and hot water. Asepsin has a sharp, sweetish taste, and the agreeable odor and flavor of oil of wintergreen. It has an alkaline reaction, and nearly all acids decompose it, producing wintergreen oil.

Action, Medical Uses, and Dosage.—Asepsin is one of the most important of the more recent introductions into medicine, and in the Eclectic school is the most extensively-employed agent for antiseptic purposes where putridity is to be overcome. Applied to the skin in solutions of greater or lesser density it imparts to the surface a sensation of slipperyness. If the skin be unbroken a sensation of warmth is very quickly produced by even a 10 per cent solution. Stronger solutions slightly redden the skin and impart a feeling of stiffness. Applied to the mucous tissues it acts energetically. It slightly liquefies albumen, differing thereby from carbolic and salicylic acids in not causing coagulation and consequent hardening of the tissues.

Taken internally asepsin imparts a feeling of warmth, and in doses of a grain or upwards causes an appreciable rise in the body temperature, and quickens respiratory action. The renal and cutaneous functions are also augmented by it. Large doses cause intense burning in the stomach, with dryness of the fauces, and these sensations may extend to the rectum after an evacuation. It does not appear to be readily absorbed, as most of it, as shown by its odor, passes through the bowels as methyl salicylate. However, small doses, well triturated with starch or milk sugar appear to be taken up by the blood, and may be detected in the urine by the test for salicylic acid, the odor of wintergreen, however, persisting. Pepsin, pancreatin, and other similar ferments are not affected by asepsin. On the contrary, minute doses encourage digestion.

Asepsin possesses decided antiputrefactive and antifermentative properties. When fermentation and putrefaction are brought about by the presence of formed ferments they are promptly arrested by the exhibition of asepsin. The remarkable preservative power of asepsin was well illustrated in the experiments conducted by Prof. Lyman Watkins, M. D. Comparative tests were made with distilled water, mercuric chloride solution, and solution of asepsin. Fish, beef, and mutton were immersed in these solutions, and kept in moderately warm situations. The preservative power of the asepsin solution proved greater than that of the others, the flesh being preserved about three times as long as by the bichloride solution (1 to 20,000). Not only did the asepsin retard decomposition, but checked the decomposition already proceeding in a piece of the flesh removed from one of the other solutions. Neither did it attack the flesh, which showed no change under the microscope, whereas that subjected to the action of corrosive sublimate exhibited a white film of coagulated albumen. It effectually checks alcoholic fermentation in cider (see below).

Therapeutically asepsin is an agent of great value. Internally exhibited it acts as a corrector and preventer of fermentation and putrefaction. Many have employed it in small doses as an intestinal antiseptic in *cholera infantum*, *dysentery*, and *typhoid fever*. The dose, however, should be but a fraction of a grain, lest an increase of temperature be provoked. Asepsin is exceedingly useful in *flatulent conditions* of the stomach and bowels. In minute doses it favors digestion, and may be employed where digestion is sluggish and the meal is followed by offensive ructus. In *gastro-intestinal disorders* it acts best after excessive acidity has been first modified by the indicated alkali. Though alkaline itself it is often insufficient to entirely overcome such conditions, hence its association with the carbonates, as magnesia, and particularly with sodium bicarbonate. Fearn recommends a combination of the latter character prepared as follows: ℞ Asepsin, grs. v to xv; sodium bicarbonate, ʒi. Triturate well. Dose, 1 to 3 grains. This, like asepsin alone, is indicated by the clean, white tongue, with pallor of the membranes, gastric fermentation, and flatulence and atony, associated with gaseous distension of the abdomen. A dusky coloration of the membranes also indicates asepsin. In *dyspeptic disorders*, Prof. McMillan associates with it pepsin or hydrastis, as indicated; it may also be combined with papoid, ingluvin, nux vomica, etc., and similar digestive ferments and tonics. When a cadaverous fetor contaminates the breath, we have added to its solution potassium chlorate; and with a dirty, pasty tongue, with a mawkish, unpleasant odor short of cadaveric, sodium sulphite. In many of the disorders in which asepsin may be exhibited internally it may be added to the solutions of other medicines, serving at the same time to prevent them from decomposition, especially in hot weather. Thus it may be given with nux vomica, hydrastis (with Lloyd's hydrastis it forms a precipitate), etc.; combined with resinous alcoholic preparations, such as podophyllum, macrotys, etc., it serves to make better mixtures, and seemingly renders them more efficient. This is particularly true of macrotys in *rheumatism*, the asepsin, like other methyl salicylates, undoubtedly possessing antirheumatic qualities. It must be remembered, however, that asepsin, on account of its strong alkalinity, should not be added to solutions containing considerable amounts of toxic alkaloids, as belladonna, aconite, gelsemium, etc., lest, by precipitation of these bases, the patient's life be endangered by getting a large dose of the deposited alkaloids when the last doses of medicine in the glass or bottle are administered. *Stomachic* and *intestinal dyspepsia* of catarrhal forms are benefited by asepsin, and it is one of the best agents to control that unpleasant rolling of gases in the bowels (*borborygmus*) so annoying to women. Asepsin may be administered in *gastric cancer* to overcome the stench; it is also useful in *gastric ulcer*. *Diarrhœa*, with fetid evacuations, is benefited by asepsin. Asepsin has also been used internally in *scarlatina* and *diphtheria*, chiefly for its stimulating and disinfecting action. Asepsin appears to be capable of restraining *passive hemorrhage*. Prof. R. L. Thomas (*Ec. Med. Jour.*, 1888, p. 71) reports a case of severe and alarming hemorrhage from a uterine fibroid, from which the patient was gradually becoming anemic and dropsical. Six weeks' treatment with ℞ Asepsin, grs. x; aqua fl℥iv; mix; teaspoonful every ½ or 1 hour during the hemorrhage, and 4 times a day during the interval, cured the patient.

As a local antiseptic asepsin has had a more extended use in the Eclectic school than any other topical agent of this class. Very dilute solutions act as a pleasant cleansing agent; solutions of 20 per cent or higher are mildly caustic, but do not leave a scar nor dry the secretions. *Wounds* treated with asepsin or asepsin in hamamelis heal kindly. Applied to *cancerous growths* its deodorant effects are remarkable. Applied to an extensive and foul cancer after death it removed the odor so effectually that no stench could be observed at the time of burial three days later. It is useful to assist in curing and in removing fetor from foul and intractable *scrofulous ulcers* and *buboes; offensive armpits* and *fetid feet* are deodorized by it. Applied to *burns* it controls the pain and promotes healing, with less tendency to cicatrization than by other forms of treatment. A cerate or ointment of it may be applied, having previously well-washed the parts with a moderately-strong solution of asepsin in water. An elegant dressing for *burns*, *scalds*, *cuts*, *abrasions*, *lacerations*, and *contusions* consists of a solution of 5 to 10 grains of asepsin in 1 fluid ounce of distilled hamamelis. In all *surgical operations* asepsin may be used in solution as a wash and applied in trituration, or solution as a dressing Dr. A. P. Taylor employs a solution of 3 grains of asepsin to 1 ounce of water to wash out *thoracic abscesses*. Many *skin affections* requiring alkaline medication and strict cleanliness may be treated with a solution or ointment of asepsin. It is especially useful in *rhus poisoning*, *porrigo*, *chronic eczema*, and *crusta lactea*. A solution of asepsin, or combined with hamamelis, sodium sulphite, or potassium chlorate, is very effectual in the *angina of scarlatina*, and assists in removing the false membrane of *diphtheria*. *Vegetative growths* may be removed with a 20 per cent solution of asepsin. Cloths wetted with asepsin solution (7½ grains to aqua Oj) and applied to the breasts may abort *mammary abscess*, when irritable and *chapped* *nipples* are a complication. Mixed with egg albumen it also forms a good application to *sore nipples*. To cure foul, indolent *tibial ulcers* Prof. John Fearn recommends the addition of 5 grains of asepsin to 1 ounce of ointment of Umbellularia californica (leaves, 8 ounces; petrolatum, 1 pound; cook until crisp, and strain), the parts having first been washed with a solution of asepsin. An ointment of asepsin has given excellent results in *pruritis ani*. Triturated with an equal amount of bismuth subnitrate and applied locally (associating with this the internal administration of apis, podophyllum, and hamamelis), it has cured a long-standing case of *piles* (Dr. W. P. Best, *Ec. Med. Jour.*, 1894).

Asepsin has a wide application in *gynæcological* and *obstetrical practice*. For foul-smelling, acrid *leucorrhœa* a wash of asepsin forms an effectual treatment, and more especially if combined with borax. As a cleansing and deodorant application after *labor* it has no superior. An injection of hot asepsinated water, with or without the addition of borax or potassium chlorate, does excellent service in cleansing the parts of the foul discharges due to fragments of *retained placenta*, the womb being first curretted, and in removing offensive *lochial accumulations*. It has thus rendered excellent service after the birth of dead and decayed fetuses. *Gonorrhœa* in the female, as well as in the male, is well treated by a small portion of asepsin (½ grain) in about 4 fluid ounces of warm water or liquid albolene.

Asepsin is extensively employed in the treatment of *catarrhal disorders* of the nose and naso-parynx. Its agreeable odor, stimulant effects, and cleansing powers make it particularly desirable for this purpose. It may be used alone or in combination with other agents, generally in solution, in water, liquid albolene, or colorless hydrastis, as a douche or spray. It is particularly adapted to *ozena*. An ointment is sometimes used in mild cases. It is one of the few agents that gives decided relief in *periodical hyperæsthetic rhinitis* or *hay fever*. For this purpose the following ointment may be used to relieve the distressing irritation and consequent sneezing: ℞ Asepsin, grs. vj; cocaine hydrochlorate, grs. j; petrolatum, ℥i. Mix. Sig. Apply to mucous membrane of the nose as needed. A solution of menthol and asepsin in liquid albolene is also effectual in this disorder.

A solution of asepsin is very useful as an ordinary gargle and mouth-wash to cleanse the parts of *foul accumulations*. For this purpose it is often desirable in *typhoid* and other *fevers*, and particularly for the insane, who are prone to allow particles of food to accumulate upon the teeth, which give rise to dental caries and offensive breath. Combined with chalk, orris-root, or charcoal it forms a useful dentifrice. F. I. Sumner, D. D. S. (paper before *Twenty-seventh Annual Meeting of Sixth District Dental Society of New York*), recommends solution of asepsin for *syringing cavities* previous to treatment or filling. For removing *stains* from the enamel he employs the following with which to apply powdered pumice to the teeth: ℞ Asepsin, ʒi; alcohol, ʒiv; glycerin, ʒxij. Mix by agitation. He also advises the foregoing *Liquid Asepsin* as preferable to other antiseptics, being non-injurious to the metallic surfaces, for disinfecting instruments and mouth-mirrors; the glycerin, by leaving a transparent film on the glass, also serves to prevent clouding of the mirror by the patient's breath. Sprinkling a little asepsin in the water before preparing plaster for impressions is also advised to modify the unpleasant flavor of the mass; *putrescent dental pulp* may be treated with asepsin, and kneaded with gutta-percha it may be utilized for root-filling. Its pleasant odor and flavor, and its freedom from poisonous and corrosive qualities, make it one of the best of antiseptics for dental operations.

Asepsin may be used in place of the more dangerous antiseptics in *ocular surgery*. For this purpose 1 grain of asepsin to 1 fluid ounce of distilled water is a desirable strength. It prevents purulent complications and keeps the traumatic surfaces in a healthy condition. The commoner local medicines (silver nitrate excepted) employed in ocular therapeutics may be dissolved in the above solution. It will prevent a sediment forming in cocaine solutions (W. P. Biles, *Ec. Med. Journ.*, 1896, p. 504). *Conjunctival inflammations*, and particularly *catarrhal* and *purulent forms of conjunctivitis*, are benefited by cleansing washes of asepsinated water.

Asepsin, as pointed out by Dr. Albert Sayler, is an excellent preservative of cider. The following mixture is advised for a barrel of cider (45 gallons). Take of strong alcohol 10 fluid ounces; oil of sassafras, ½ fluid ounce; asepsin, ⅔ ounce. Mix in a bottle in the order named. If the cider be clear of pomace add at once; if not clear allow it to stand a day before adding the preservative. Such a cider Dr. Sayler advises in doses of 2 glasses a day in persons inclined to *muscular* and *arthritic rheumatism*, which treatment he claims is effectual as a preventative of these disorders.

The dose of asepsin for internal use ranges from a fraction of a grain to ½, and rarely 1 grain. As a local application solutions varying from 1 to 20 per cent may be employed as circumstances warrant; ointments and liquid albolene solutions may be used of similar strengths. Of the compound powder of asepsin (grs. x to xv) and sodium bicarbonate (℥i) the dose may range from 1 to 20 grains. A SOLUTION OF BORATED ASEPSIN, advised for internal and external use, is prepared by Prof. Fearn as follows: Take of asepsin, ʒi; glycerin, fl℥ii; sodii boras, ʒi; aqua destillata, fl℥vi. Place the asepsin in a mortar, and little by little add the glycerin, triturating until well mixed. Make a solution of the borax and distilled water, and lastly mix the two solutions by agitation. Besides the uses above mentioned this solution may be used as a spray or wash for *purulent conjunctivitis* and as a wash for *bladder affections*.

Specific Indications and Uses.—Fermentation and putrefaction; pale tongue, or dusky discoloration of throat and tongue; fermentative dyspepsia, with atony, flatulence, and colicky pain; abdominal tympanites; borborygmus, prune-juice evacuations; feeble capillary circulation, with tendency to breaking down of tissues; rhus poisoning, ulcerations, etc. A general antiseptic for surgical, gynæcological, and obstetrical manipulations.

Preparations.—ASEPTANILIDE. Dr. B. K. Jones, of Kenton, Ohio, has formulated a combination of asepsin (5 grains) and acetanilid (1 ounce), which he regards as an excellent remedy for various forms ot *headache*, and especially those characterized by sharp, lancinating pains. If taken early, before the stage of nausea ensues, it will abort *sick headache* and *sea-sickness*. Externally employed Dr. Jones declares it an admirable dry-dressing for *wounds*, etc. He suggests for this compound the name ASEPTANILIDE.

ASEPSIN SOAP.—This is a pure animal-fat (tallow) soap, into which is incorporated borax and *asepsin*. It comes in rounded, oblong cakes of a pearly, pale, bluish-white color, approaching to olive, and has a somewhat foliaceous appearance. It is not perfumed, but possesses a clear, tallow-like odor, pleasantly modified by the presence of the asepsin it contains. It is perfectly non-irritating, and is the only medicated soap exclusively of Eclectic pharmacy. Asepsin soap is used both as a medicated soap for skin affections and as a toilet soap. Originally intended only for professional use, the laity have learned that a soap possessed of its cleansing qualities, and which leaves no odor on the skin, and is unchangeable under atmospheric influences, is the most desirable soap for toilet purposes.

Asepsin soap may be employed with safety and benefit whenever soap is desired in surgical, obstetrical, and gynæcological manipulations, and is unsurpassed as a general cosmetic soap, particularly for the toilet of infants. Perfectly unirritating, it may be used on the most delicate skin, and employed where the cutaneous surface is rough and dry and the sebaceous functions imperfect. It renders the skin soft and pliable. *Acne, comedones, milium, seborrhœa, herpes, impetigo, pruritic disorders*, and *parasitic, syphilitic*, and *ulcerative affections* are benefited when a part of the treatment consists of the application of this soap. It hastens desquamation after the *exanthemata*. It removes *dandruff, crusts*, and *greasiness of the scalp*. In dry, scaly forms of *eczema* its application forms an important part of the treatment, and excellent results have followed its use in *acute* and *chronic rhus poisoning*. For its medicinal effects a thick lather may be applied and left to dry upon the parts, or in some instances after remaining upon the skin for from 15 to 30 minutes the latter should be removed from the surface with hot or cold water, as indicated.

ASIMINA.—PAPAW.

The seed of *Asimina triloba*, Dunal (*Anona triloba*, Linné; *Orchidocarpum arietinum*, Michaux; *Porcelia triloba*, Persoon; *Uvaria triloba*, Torrey and Gray).

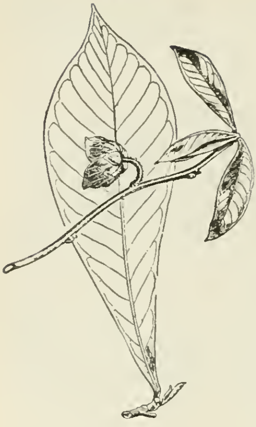
Nat. Ord.—Anonaceæ.

COMMON NAMES: *Papaw, Pawpaw, Asiminer* (Louisiana), *American custard-apple*.

ILLUSTRATION: Lloyd's *Drugs and Medicines of North America*, Vol. II, plate xxxiii.

Botanical Source.—This is a small and beautiful indigenous tree, growing from 10 to 20 feet high. The young shoots and expanding leaves are clothed with

Fig. 35.



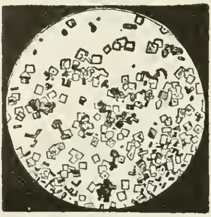
Asimina triloba.

a rusty down, soon glabrous. The leaves are thin, smooth, entire, ovate-oblong, acuminate, 8 to 12 inches long, by 3 or 4 broad, tapering to very short petioles. The flowers are dull-purple, axillary, and solitary; the petals veiny, round-ovate. the outer ones orbicular, and three or four times as large as the calyx. The flowers appear early with the leaves (which are then small), and are about 1½ inch wide. The fruit is a yellowish, ovoid-oblong, pulpy pod, 2 or 3 inches long by about 1 inch in diameter, fragrant, sweet, edible in autumn, and contains about 8 seeds (W.—G.).

History.—The papaw (sometimes improperly called the American custard-apple tree) is an inhabitant of the Middle, Southern, and Western States, growing in rich soil, and on the banks of streams, and flowering from March to June. The fruit is large and fleshy, and has an unpleasant odor, but when ripe and after frost, the pulp is sweet, luscious, and yellow, similar to custard; it is considered a healthy fruit, and is sedative and laxative. The seeds, which are the parts used, have a fetid odor, similar to stramonium; they are covered with a tough, hard, exterior coat, of a light-brownish color and smooth externally, lighter and wrinkled internally, inclosing a kernel of a whitish-yellow color, compressed, deeply fissured on both sides, nearly inodorous, very faintly bitter and sweetish, and dry and branny when chewed, leaving a very persistent, faint, but rather unpleasant sensation of nausea. They are of various shapes, being flat, ovoid, nearly circular, or somewhat reniform, with a longitudinal furrow or depression along the center of each of the flat surfaces, and frequently a ridge or elevation instead of the furrow. They yield their properties to alcohol. This fruit must not be confounded with the *true papaw*, from the *Carica Papaya*, an American tropical plant, whose fruit is the true *custard-apple.*

Chemical Composition.—The only chemical investigation of papaw seeds that we are aware of has been made by Prof. J. U. Lloyd, who isolated therefrom an alkaloid exhibiting anodyne properties, and to which he gave the name *asiminine.* It occurs as a white, tasteless, and colorless, amorphous alkaloid. In water it is practically insoluble, though it freely dissolves in alcohol and ether, and less readily in chloroform and benzol. Its soluble salts, and most of them are freely soluble in water, are bitter. Diluted alkalies precipitate the alkaloid from such solutions. The hydrochlorate, the salt most available for medicinal use, forms beautiful crystalline squares, or "interlocked sections of cubes," odorless, white, "at first sweetish, then bitter, leaving a bitter after-taste." Crystalline laminæ are the forms assumed by the sulphate. Nitric acid strikes with it a *carmine* red, quickly changing to deep-black purple. The reaction is delicate, and should be differentiated from morphine, in that its color is not *blood*-red, and that it deepens to purple, and finally to dark red. It does not become lighter in color, nor does it turn yellow when treated with nitric acid. All parts of the asimina tree yield a fetid, volatile oil, and bitter extractive was obtained from the bark (see Lloyd's *Drugs and Medicines of North America*, Vol. II, pp. 54, 55).

Fig. 36.



Crystals of hydrochlorate of asiminine from alcoholic solution.

Action, Uses, and Dosage.—Emetic, for which purpose a saturated tincture of the bruised seeds is employed, in doses of from 10 to 60 drops. The bark is said to be a bitter tonic, and has been used as such in domestic practice. The medical properties of this agent have not been fully investigated.

ASPARAGUS.—ASPARAGUS.

The young shoots and roots of the *Asparagus officinalis*, Linné.
Nat. Ord.—Liliaceæ.

Botanical Source.—The asparagus is a perennial plant, with an erect, round, unarmed, very branching, herbaceous stem, from 2 to 4 feet high. The leaves are setaceous, flexible, filiform, and fasciculate, from ½ to 1½ inches long, and of a pale-green color. The flowers are axillary, small, and greenish in color, either solitary or in pairs, and are succeeded by handsome red berries, which are globose and three-celled, each cell containing 2 seeds.

History and Description.—This herb is indigenous to Europe, and is extensively cultivated there, as well as in the United States, as an article of diet. The root has a faintly saccharine flavor, but no odor, and is active only when in the recent state. It is a short rhizome, from ½ to ¾ inch thick. Stem-scars mark its upper surface, while from beneath many long white roots are given off, which become longitudinally furrowed on drying. The fresh roots were formerly much more used than at present, though they are still used by the French. The young shoots, which are employed as an article of diet by many, have a disagreeable taste, which is removed by boiling with water.

Chemical Composition.—Vauquelin and Robiquet (1805) found in the juice, *asparagin* ($C_4H_8N_2O_3.H_2O$), which crystallizes in right rhombic prisms, is odorless, and without taste, and refuses to dissolve in alcohol and ether. The same principle is found in other plants, notably althea, in which it was found by Bacon in 1826; also mannit, oleoresin, wax, albumen, salts, etc..

In 1870 Reinsch discovered glucose in the berries and an orange-red coloring principle, sublimable and crystallizing as scales from ether, to which the name *spargancin* has been given. The seeds contain sugar, fixed oil, a fragrant resin, and a bitter body, *spargin*, capable of crystallization.

Action, Medical Uses, and Dosage.—Both the fresh roots and shoots act as diuretics, communicating an unpleasant odor to the urine. A syrup is prepared by adding sugar to the expressed juice, deprived of its albumen by heating and straining, or an extract may be prepared from them by evaporation of the juice to a semi-solid condition. The dose of the former is from 2 to 3 fluid ounces; of the latter, from 30 to 60 grains. They are said to cause copious diuresis, and are reputed very beneficial in repressing undue excitement of the circulatory system, and have been used with advantage in *enlargement of the heart, dropsy*, etc. It is said that asparagus shoots may produce irritation of the urinary mucous surfaces, attended with a morbid mucorrhœa.

ASPIDIUM (U. S. P.)—ASPIDIUM.

"The rhizome of *Dryopteris Filix-mas*, Schott. and of *Dryopteris marginalis*, Asa Gray"—(*U. S. P.*). The first is the *Aspidium Filix-mas* of Swartz and others, and the *Polypodium Filix-mas* of Linné. It has many other synonyms. The second is the *Aspidium marginale* of Willdenow.

Nat. Ord.—Filices.

COMMON NAMES: (1) *Male-fern*, (2) *Marginal shield-fern*.

ILLUSTRATIONS: Bentley and Trimen, *Med. Plants*, 300; Woodville's *Med. Bot.*, Pl. 271; Johnson's *Med. Bot. of N. A.*, Fig. 160 and Pl. ix.

Botanical Source.—Male-fern (*Dryopteris Filix-mas*) has a large, perennial, tufted, scaly rhizome, sending forth yearly several leaves, 3 or 4 feet high, erect, disposed in a circle, oval, lanceolate, acute, pinnate, bright-green, and leafy nearly to the bottom; their stalks and midribs having tough, brown, transparent scales throughout; divisions alternate, taper-pointed, and pinnate; the pinnæ or leaflets numerous, crowded, sessile, for the most part distinct, occasionally somewhat combined at the base, oblong, obtuse, crenate throughout, the lateral notches broadest and most shallow, the terminal ones more crowded and acute, without any terminal bristles; both sides smooth, destitute of glandular globules, but having a depression on the upper one over the insertion of each sorus. The sori are circular, tawny, arranged in simple, close, short rows, near the partial midrib, scarcely occupying more than the lower half of each leaflet. The indusium is circular, durable, crenate, and tumid, with a cleft terminating in the central depression. The thecæ are numerous, shining-brown, and prominent all round for a little beyond the indusium (W.—L.).

Dryopteris marginale differs from the preceding mainly in having its fruit dots or *sori* arranged upon the margins of the fronds, the latter being from 1 to 2 feet in length, of an ovate-oblong shape, and light-green color. The pinnæ are lance-shaped, with an almost sessile, broad base; the pinnules are crowded, and are oblong in outline, with an obtuse termination.

History and Description.—Male-fern is found growing in many parts of Europe, and likewise in various sections of the United States. It is also found in South America, Africa, Asia, from the Himalayas northward, and in the islands of Polynesia. The dried root or rhizome is the official part, which, divested of its leaf-stalks and radicles, is from 8 to 12 inches in length and 1 or 2 inches thick, compressed, tortuous, tuberculous, brown or dark-brown epidermis, yellowish, rarely reddish parenchyma, fragile, striated, almost inodorous, with a nauseous sweet taste, but at last becoming rancid, slightly astringent and bitter. The fibrous radicles are covered with brown, paleaceous scales (*Ed.*). The *U. S. P.* thus describes the official drug: "From 5 to 15 Cm. (2 to 6 inches) long, 10 to 25 Mm. (½ to 1 inch) in thickness, and, together with the closely imbricated, dark-brown, roundish, and slightly curved stipe-remnants, 50 to 75 Mm. (2 to 3 inches) in diameter; densely covered with brown, glossy, transparent, and soft, chaffy scales; internally pale green, rather spongy; vascular bundles about 10 (*Dryopteris Filix-mas*) or 6 (*Dryopteris marginalis*) in number, arranged in an interrupted circle; odor slight, but disagreeable; taste sweetish, acrid, somewhat bitter, astringent, and nauseous. The chaff, together with the dead portions of the rhizome and stipes, should be removed, and only such portions as have retained their green color should be used"—(*U. S. P.*). The fresh root is colored bluish-black by iodine, which is indicative of the presence of starch. From the first of June to the latter part of September is the proper time for collecting it—when it should be cleansed without being washed, then dried quickly in the shade and open air without heat. Select those parts which are greenish internally, immediately pulverize them, and keep in well-closed bottles. The powder is pale greenish-yellow, and has a peculiar earthy, disagreeable odor, and the same taste as the crude root (C.). In two years the best article becomes useless.

Chemical Composition.—According to Geiger male-fern contains green fat oil (composed, according to Luck, of glycerides of *filosmylic* and *filixolic acids*), green resin, uncrystallizable sugar, easily oxidizable tannic acid, gum, salts, starch, and lignin. In addition to these Bock found fixed and volatile oil, pectin, albumen, etc. According to Peschier, the fern-buds contain a volatile oil, brown resin, fat oil, solid fatty matter, green coloring principle, a reddish-brown principle, and extractive. Three acids have been found by Dr. C. Luck in the root; two from the root itself, named "*tannaspidic*" and *pteritannic acids*" (soluble in ether), and one from its oil, termed "*filicic acid.*" The latter has the formula, $C_{14}H_{18}O_5$--according to Grabowski (1867) or $C_{13}H_{14}O_4$ (Luck) or $C_{14}H_{16}O_5$ (Daccomo, 1889). The first-named regards it as *dibutyryl-phloroglucin*, for at near the fusing point of potassium hydroxide the latter decomposes it into butyric acid and phloroglucin. An impure filicic acid constituted Pavesi's (1861) *aspidin*. Malin (1867) isolated but one tannin, and to it he gave the name *filitannic acid*. Protecatechuic acid and phloroglucin result when this acid is fused with caustic potash; and when boiled with diluted mineral acids it yields glucose and *filix-red* (impure tannaspidic acid of Luck). Daccomo (*Amer. Jour. Pharm.*, 1889) found a white wax-like body, having the composition $(C_{13}H_{26}O)_{n}$., filicic acid, tannin, glucose, filix-red, a green oil, a brick-red, and a black, plastic resin.

Marginal shield fern yields filicic acid and a tannin probably identical with that of male-fern (Patterson, 1875).

The oil may be obtained by digesting the powdered root in pure ether, filtering, and then distilling or evaporating the ether from the ethereal tincture. It is a thick black oil, having the taste and odor of the root, reddening vegetable blues, depositing stearin when left at rest, and yielding a little volatile oil when distilled from water. Alcohol partially dissolves it; it burns with a thick smoke, and is composed, according to Peschier, of fat, resin, volatile oil, coloring matter, extractive, chloride of potassium and acetic acid.

Action, Medical Uses, and Dosage.—Aspidium was the secret tænicide of Madame Nouffer, and was purchased of her by the French King in 1775. The oleoresin has been shown to be poisonous, five fatal cases out of twenty being recorded (Katayama and Okamoto, 1892). Vomiting, purging, headache, dizziness, dyspnœa, cold perspiration, cyanosis, disordered intellect, profound stupor, and convulsions are among its effects. In some cases amblyopia and permanent amaurosis have occurred, though the vision is generally restored.

Male-fern is used for the expulsion of the *tapeworm*. Bremser says it is an excellent remedy against the *Bothriocephalus latus*, but it is not so efficient against the *Tænia solium*, and Merat entertained a similar opinion. According to Peschier the best mode of administration is the ethereal oil or extract, of which 18 grains, or from 10 to 25 drops, may be given in the form of pill or emulsion at night and again in the morning; 2 hours after the administration of the last dose a purgative dose of castor oil is to be taken, and the worm is discharged dead, without any severe or unpleasant symptoms. Dose of the powder, 1 to 4 drachms; of the ethereal tincture of the buds, which is made by digesting 1 part of the buds in 8 parts of ether, 8 to 30 drops (see also *Oleoresina Aspidii*).

Related Species.—*Polypodium incanum*, Pursh. Said to be employed by Alabama negresses to prevent conception. It is a popular Southern remedy for *dysmenorrhœa*. Emmenagogue.

Aspidium rigidum, Swartz. Europe and Pacific coast range. Contains same constituents as Filix-mas, and in California is used like it as a popular tænicide,

Asplenium Filix-fœmina, Bernhardt. Reputed tænicide. The rhizome of *Asplenium thelypteroides*, Michaux. North America. Resembles the preceding.

Aspidium Athamanicum, Kunze. South Africa. The *inkomankomo* (*uncomocomo*) of the Kaffirs and *pannum* (*Rhizoma Panna*) of commerce. Tæniifuge. Contains *pannic acid*, a principle closely related to *filicic acid* (see Kürsten in *A. P. A. Proceedings*, 1892, p. 605).

Scolopendrium officinarum, Smith (*Asplenium Scolopendrium*, Linné). *Hart's-tongue*. A fern indigenous to Europe and America, whose leaves have a sweetish, mucilaginous, subastringent taste. An unpleasant oleaginous odor is emitted if the leaves be rubbed. They have been variously employed as a demulcent in *disorders of the respiratory tract*, as a deobstruent in *affections of the abdominal contents*, and as an astringent in *excessive discharges* and *hemorrhages*.

ASPIDOSPERMA (U. S. P.)—ASPIDOSPERMA.

"The bark of *Aspidosperma Quebracho-blanco*, Schlechtendal"—(*U. S. P.*).

Nat. Ord.—Apocynaceæ.

COMMON NAME: *Quebracho*.

Botanical Source.—This tree is a large evergreen, having pendant branchlets, bearing small elliptic-lanceolate, acutely-pointed leaves, which are opposite, or tri-verticillate, and subsessile. They have entire, stiff margins. The flowers are axillary, cymose, small, and yellow. The fruit is a ligneous capsule, containing seeds having broad wings.

History.—This tree is a native of Chili and the Argentine Republic. The variety furnishing the official drug has the lighter-colored wood, another variety having a dark wood. The former comes chiefly from the province of Salta, the latter from the province of Cordoba. The wood of this tree is exceedingly hard, and the name "*quebracho*" (from *quebrar hacho*, signifying "*breaking the axe*") is given it in its native habitat, and is equally applied to all trees having wood that is very hard. The drug was introduced into Europe, in 1878, by Schickedanz. The bark is used for tanning in some parts of South America. The bark having a thick, corky layer is preferred, and is collected from the older trees.

Description.—"In nearly flat pieces, about 1 to 3 Cm. (½ to 1⅖ inches) thick; the outer surface yellowish-gray or brownish, deeply fissured; inner surface yellowish-brown or reddish-brown, distinctly striate; fracture displaying two sharply-defined strata, of about equal thickness, and both marked with numerous whitish dots and striæ arranged in tangential lines; the fracture of the outer, lighter-colored layer rather coarsely granular, and that of the darker-colored, inner layer short-splintery; inodorous; taste very bitter and slightly aromatic"—(*U. S. P.*).

Chemical Composition.—The wood of this tree yields no alkaloids. The barks, besides containing a small amount of tannin, lævogyre inosite, and another form of sugar, denominated *quebrachit*, yields at least six alkaloids, as follows:

ALKALOID.	Discovered and named by—	Form.	Melting point.	Solubility.	Reactions.	Other properties, etc.
ASPIDOSPERMINE, $C_{22}H_{30}N_2O_2$	Schickedanz; named by Fraude (1878).	Colorless, prismatic crystals.	205° C. (401° F.).	Readily in fixed oils and fats; partially in alcohol and ether; very sparingly in water (1 in about 6000); insoluble in glycerin.	Red with warm perchloric acid; blue with platinic chloride; brown, changing to bright reddish-purple with sulphuric acid and bichromate of potassium.	Aqueous solution bitter. It has weak basic properties; is less poisonous than the other alkaloids. Salts principally amorphous.
ASPIDOSPERMATINE, $C_{22}H_{28}N_2O_2$	O. Hesse	Crystalline	162° C. (324° F.).		Red with warm perchloric acid.	Has strong basic properties. Salts amorphous.
ASPIDOSAMINE, $C_{22}H_{28}N_2O_2$	O. Hesse	Amorphous	About 100° C. (212° F.).		Blue with sulphuric acid and potassium bichromate.	Strong basic properties; isomeric with *aspidospermatine*.
QUEBRACHINE, $C_{21}H_{26}N_2O_2$	O. Hesse	Colorless crystals, changing to yellow in the sunlight.	215° C. (419° F.).	Soluble in varying degrees in alcohol, chloroform, and ether.	Yellow with warm perchloric acid; colorless with H_2SO_4, becoming blue at rest.	Salts crystalline.
HYPOQUEBRACHINE, $C_{21}H_{26}N_2O_2$	O. Hesse	Yellow, amorphous mass.	About 80° C. (176° F.).	Nearly insoluble in hot benzin.	Cherry-red with iron perchloride,	Isomeric with quebrachine.
QUEBRACHAMINE	O. Hesse	Colorless, silky, acicular crystals.	142° C. (288° F.).	Freely in cold alcohol and ether; sparingly in chloroform and benzin.		Not always present in the bark.

Action, Medical Uses, and Dosage.—Quebracho is said to be valued as an antiperiodic by the Chilians. Wounds are sometimes dressed with the fluid extract. But its chief value rests upon its property of controlling *dyspnœa*, when not due to organic changes. Some, however, contend that it is equally valuable when structural changes are present. It is valuable in both *cardiac* and *asthmatic dyspnœa*, as well as in *emphysematous states*. Being a stimulant to the pneumogastric it affects chiefly the cardiac and pulmonary plexuses, and is a remedy of marked value where there is evidence of imperfect oxygenation. The cases show a disturbed relation between the pulmonic circulation and the action of the heart. In *cardiac asthma* it is reputed one of the best remedies, and to relieve the distressing dyspnœa of *capillary bronchitis*, the latter stages of *phthisis*, advanced *bronchitis*, *asthmatic bronchitis*, and simple *asthma*, with insufficient cardiac power, it has been highly praised. Pure, uncomplicated asthma is not much benefited by it, but asthma associated with emphysema is very promptly met by it. The *cough of la grippe*, with marked dyspnœa, yields to it. Dose of the fluid extract, from 5 to 60 minims, in water, syrup, or syrup of tolu, every 2 or 3 hours; for specific uses, doses of 5 to 15 minims are preferred; of the tincture, 10 to 20 minims; of commercial aspidospermine, which is a mixture of the associated alkaloids, the dose varies from ¼ to ½ grain.

Specific Indications and Uses.—Dyspnœa of functional origin; dyspnœa with emphysema, face pale, anxious, and livid, lips cyanotic; pulse small, soft, compressible, irregular, or intermittent; orthopnœa; cardiac palpitation with cough.

Related Drugs.—*Loxopterygium Lorentzii*, Grisebach. *Nat. Ord.:* Terebinthaceæ. The *quebracho colorado* of the Argentine Republic. The wood contains a large amount of tannin and a yellow coloring matter. Hesse obtained two alkaloids, both bitter in taste, one being unnamed and the other known as *loxopterygine*. The juice of the bark forms a resinous exudation not unlike kino, and is soluble in alcohol, wood alcohol, acetic acid, acetic ether, acetone, and boiling water (Arate). Has been used as a substitute for aspidosperma, but is weaker in action.

Iodina rhombifolia, Hooker and Arnott. *Nat. Ord.:* Aquifoliaceæ. *Quebracho flojo.* Used as above and often gathered with it.

Machærium fertile, Grisebach. *Nat. Ord.:* Leguminosæ. *Tipa tree.* Uses same as preceding species.

Croton pseudochina, Schlechtendal, Mexico. Source of *Copalchi-bark*, which is occasionally sold as quebracho bark.

ASTER PUNICEUS.—RED-STALKED ASTER.

The root of the *Aster puniceus*, Linné.

Nat. Ord.—Compositæ.

COMMON NAMES: *Red-stalked aster*, *Cocash*, *Meadow scabish*, *Squaw-weed*.

Botanical Source.—The root of this plant is perennial and fibrous. It has a hispid stem, paniculate above, furrowed, generally red, or at least on the south side, stout and tall, growing from 3 to 6 feet in height. The leaves are oblong-lanceolate, amplexicaul, more or less auriculate at the base, sparingly serrate in the middle with appressed teeth, rough above, nearly smooth underneath and pointed; the lower leaves have remote serratures, are rough-edged, rough on the upper surface, and all acuminate and narrowed at the base. The involucre is loose and longer than the disk; the scales linear-lanceolate, long, revolute, nearly equal, in two rows. The flowers are large, showy, of a pale-purple or lilac-blue color, having from 30 to 60 long, narrow rays.

History and Description.—This plant is found growing in various parts of the United States, in swamps, ditches, along the borders of small streams, and sometimes in dry soils. It flowers from July to October. The radicles or fibers of the root are the parts used; they are about the size of a pipe-stem, having a pungent, aromatic odor and taste, with some bitterness and astringency. Water or alcohol extracts their active properties. This species has several varieties—*vimineus*, *glaber*, *firmus*, and *candidus*. The second variety and the candidus have white flowers.

Action, Medical Uses, and Dosage.—Stimulant and diaphoretic. The warm infusion may be used freely in *colds*, *rheumatism*, *nervous debility*, *headache*, *pains in the stomach*, *dizziness*, and *menstrual irregularities*. This, together with *A. cordifolius*, has been compared in value with valerian. Infusion (℥ss to aqua Oj) freely.

Related Species.—*Aster æstivus*, Aiton; *Rheumatic-weed*, *Sampson snake-root*, *Star flower*, etc., resembles the above plant, having lanceolate, subclasping leaves, tapering to the apex; margin rough; stem branching from its base, erect, hispid; branchlets pilose; involucre scaly; scales lax, linear, acute, equal. Flowers middle-sized, blue. It is found more abundantly west of the Alleghany Mountains, and is recommended as an antispasmodic and alterative. Principally used in the cure of *rheumatism* in the form of infusion or tincture; recommended, however, in *hysteria*, *chorea*, *epilepsy*, *spasms*, *irregular menstruation*, etc., internally; and used both externally and internally in many *cutaneous diseases*, the eruption occasioned by the *poison rhus*, and in the *bites* of venomous snakes. Dose of the infusion, 1 to 4 fluid ounces; of a saturated tincture, ½ drachm to 2 drachms. This plant deserves further investigation.

Aster cordifolius, Linné. *Heart-leaved aster*. United States. According to Rafinesque (*Med. Flora*, II, 198), "an excellent aromatic nervine, in many cases preferable to valerian." It is also reputed antispasmodic. The root is the part used. A decoction has been used in *rheumatism*.

Aster Novæ-Angliæ, Linné. *New England aster*. United States. A beautiful plant, especially when cultivated. It has rose-purple, occasionally white flowers. Used in *skin eruptions* and valuable for *poisoning by poison sumach* (Rafinesque, on authority of Dr. Lawrence).

Seriocarpus tortifolius, Nees (*Aster tortifolius*, Michaux). *White-tipped aster*, *Mouse ear*. Pine barrens of the United States. Summit usually covered with insects (Porcher). Diuretic.

ATROPINA (U. S. P.)—ATROPINE.

FORMULA: $C_{17}H_{23}NO_3$. MOLECULAR WEIGHT: 288.38.

SYNONYM: *Atropia.*

"An alkaloid obtained from belladonna. As it occurs in commerce it is always accompanied by a small proportion of hyoscyamine extracted along with it, from which it can not be readily separated"—(*U. S. P.*).

Preparation.—An easy process for the preparation of atropine is as follows: One pound of the dry leaves of belladonna are to be boiled in distilled water sufficient to cover them for 2 hours, and the decoction strained off through a coarse cloth into a large precipitating jar. The leaves are again boiled in a second water and the decoctions mixed, to which 2 drachms of strong sulphuric acid are now added; the vegetable albumen is precipitated, and the clear liquor is drawn off with a siphon to a filter. A clear, sherry-colored solution comes through, which is either decomposed by passing gaseous ammonia through it, or by adding commercial carbonate of ammonium. In either case the color becomes changed to black, and crystals of atropine are slowly formed. At the expiration of a day or so the supernatant liquor may be drawn off with a siphon, and the crystals thrown on a filter to dry. To decolorize them, about 1 ounce of spirit of ammonia may be poured on the filter, which washes away most of the coloring matter, leaving the crystals moderately white. Purify by dissolving in boiling alcohol and recrystallizing.

Bouchardat states that by dissolving crude atropine in acidulated water, and then adding an alkaline carbonate to neutralize the acid, a deposit of resinous matter occurs at first, succeeded by a pulverulent precipitate, which is alkaline; this is atropine (though by some has been considered as a distinct substance), and has sometimes received the name of *belladonnine*.

Description and Tests.—The Pharmacopœia thus describes atropine: "White, acicular crystals, or a more or less amorphous, white powder, without odor, having a bitter, acrid taste, and gradually assuming a yellowish tint on exposure to air. Soluble at 15° C. (59° F.) in 130 parts of water, 3 parts of alcohol, 16 parts of ether, 4 parts of chloroform, and about 50 parts of glycerin. At about 108° C. (226.4° F.) it melts, forming a colorless liquid; at about 140° C. (284° F.) it begins to give off white, acrid fumes, and, when ignited, it is consumed without leaving a residue. It has a markedly alkaline reaction; its saturated aqueous solution acquires a pink color upon the addition of a drop of phenolphtalein T.S. If a small quantity of atropine, or of one of its salts, be heated with a few cubic centimeters of concentrated sulphuric acid, a peculiar odor recalling that of a mixture of rose, orange-flower, and melilot will become noticeable. On now gradually adding minute fragments of potassium dichromate the odor will change to that of oil of bitter almond, the rose odor disappearing as more dichromate is added. Atropine and its salts are decomposed by prolonged contact with sodium or potassium hydrate, and if heated with either of them evolve ammonia. On dissolving a small quantity (about 0.1 Gm.) of atropine in 2 Cc. of alcohol, and adding an equal volume of mercuric chloride T.S.; a yellow precipitate, which soon turns red, is produced. On adding concentrated sulphuric acid to atropine no color should be produced (absence of readily carbonizable, organic impurities), nor should any color be developed by the subsequent addition of nitric acid (absence of and difference from morphine). The aqueous solution of atropine, or of any of its salts, is not precipitated by platinic chloride T.S. (difference from most other alkaloids). With gold chloride T.S. it gives a precipitate which, when recrystallized from boiling water acidulated with hydrochloric acid, is deposited, on cooling, in minute crystals, forming a yellow, lusterless powder on drying (difference from and absence of more than a small proportion of hyoscyamine)"—(*U.S.P.*).

The test above referred to, regarding the variety of odors produced as directed, is, beside the physiological (mydriatic) test, probably the most striking and reliable test for this substance. Manganese binoxide and potassium bichromate do not produce, with a sulphuric acid solution of atropine, a blue or purple color, thus showing the difference between this substance and *strychnine*. Its salts dissolve in water and alcohol, but are not soluble in chloroform and ether.

Chemical Composition.—The principal alkaloids contained in *Atropa Belladonna*, as atropine, hyoscyamine, hyoscine, and belladonnine, also atropamine, are substances which bear a close chemical relationship to one another, being partly isomeric and capable of being transformed into one another, *e. g.*, hyoscyamine into atropine (Schuette, 1891; O. Hesse, 1894).

Atropine and *hyoscyamine*, both of the formula, $C_{17}H_{23}NO_3$, are capable of being resolved into the alkaloid *tropine* ($C_8H_{15}NO$) and *tropic acid* ($C_9H_{10}O_3$) by treatment with baryta-water, while *hyoscine*, under these conditions, is split into *pseudotropine* ($C_8H_{15}NO$), melting at 106° C. (232.2° F.), and tropic acid.

If in these processes concentrated hydrochloric acid is employed *atropic acid* ($C_9H_8O_2$) and its polymer, *isatropic acid* ($C_{18}H_{16}O_4$) are formed, besides tropic acid. These reactions were first established by Kraut, in 1863, and Lossen, in 1866, and subsequently studied in detail by Ladenburg and other investigators. *Tropine* was found to be a pyridine derivative, viz.: *oxy-ethyl-methyl tetra hydropyridine* ($C_5H_7N.[C_2H_4OH].CH_3$). It is a strong, tertiary base, forming hygroscopic crystals, which melt at 62° C. (143.6° F.) and boil at 229° C. (445° F.). They are easily soluble in alcohol and water; also soluble in ether. Heated with fuming hydrochloric acid to 180° C. (356° F.) or acted upon by sulphuric acid and glacial acetic acid, the base *tropidine*, containing 1 molecule less of water, is formed, having the composition $C_5H_6(C_2H_4)N.CH_3$, boiling at 162° C. (323.6° F.), and resembling coniine in odor. In 1880 Ladenburg recognized *tropic acid* to be A-phenyl-B-oxypropionic acid ($CH_2OH.CHC_6H_5.COOH$). It is soluble in alcohol and ether, to some extent in water, from which solvent it crystallizes in needles or plates, melting at from 117° to 118° C. (242.6° to 246.2° F.). Ladenburg, in 1884, succeeded in obtaining atropine by synthesis from its products of decomposition by evaporating a mixture of tropic acid and tropine with hydrochloric acid. By substituting other aromatic acids for tropic acid Ladenburg, in 1884, made known a series of synthetical alkaloids, to which he gave the name *tropeïnes*, of this series tropine being the common basic constituent. *Homatropine* ($C_{16}H_{21}NO_3$) he obtained by the action of *tropine* upon *mandelic acid* ($C_6H_5.CHOH.COOH$) in the presence of hydrochloric acid. (For the chemistry of belladonna alkaloids, also see *Belladonna*.)

Action and Uses.—(See *Atropinæ Sulphas.*)

ATROPINÆ SULPHAS (U. S. P.)—ATROPINE SULPHATE.

FORMULA: $(C_{17}H_{23}NO_3)_2H_2SO_4$. MOLECULAR WEIGHT: 674.58.

SYNONYM: *Sulphate of atropia.*

Preparation.—Sulphate of atropine may be made by dissolving 30 grains of atropine in 18 fluid drachms of pure ether, and then, adding to this, drop by drop, a mixture of 3 grains of sulphuric acid, and ½ fluid drachm of alcohol (specific gravity, 0.817), which forms a milky fluid, continuing the addition of the mixture to saturation of the atropine. Then set the liquid aside, and when there is no further precipitate pour off the supernatant ether, and allow the residue to evaporate spontaneously to dryness (M. Ch. Maitre). In this process all the fluids used should be free from water, and the whole manipulation should be conducted in a cool place; the ether will hold any excess of acid or alkali, which, however, may be neutralized by adding a little more atropine or acid, as required.

Description.—Atropine sulphate is in the form of "a white, indistinctly crystalline powder, without odor, having a very bitter, nauseating taste, and permanent in the air. Soluble at 15° C. (59° F.) in 0.4 part of water, 6.2 parts of alcohol, 2270 parts of ether, or 694 parts of chloroform. At 187° C. (309° F.) the salt melts, forming a brownish-yellow liquid. When ignited it chars, emits acrid vapors, and is completely consumed. The salt is neutral to litmus paper. On adding sodium carbonate T.S. to a concentrated aqueous solution of the salt a white precipitate is obtained, which should respond to the reactions and tests given under Atropine (see *Atropina*). The aqueous solution of the salt yields, with barium chloride T.S., a white precipitate, insoluble in hydrochloric acid"—(*U. S P.*). Atropine sulphate or its solution should strongly dilate the pupil when applied to the eye. This salt is soluble in about 3 parts of glycerin.

Action and Toxicology.—The action of belladonna and its chief alkaloids is practically identical, except in degree and rapidity. The first effect of very small doses is to cause dryness and constriction in the throat, with possibly slightly disordered vision and unpleasant sensations in the head, with vertigo and confusion of ideas. Larger doses occasion mydriasis, with dimness of sight, quickened breathing, frontal headache, with mild delirium, and in some individuals a flushing of the surface with a rash closely resembling that of scarlatina, though lacking the punctations of that eruption, and rarely causing desquamation. If toxic doses be taken these symptoms are intensified. Dimness, or total loss of sight, and extreme pupillary dilatation, with brilliant, *staring* eyes, headache, and a peculiar delirium ensue. The latter consists of fancies and illusions, hallucinations, and other phantasmagoria, with laughter and gayety, or the cerebral disturbance may lead to violent and furious delirium, with fighting propensities. The respiration is decidedly increased, as well as the frequency of the pulse, which is now hard and small, and the body temperature rises from ½° to 1° F. The latter falls, however, when vaso-motor paresis takes place. These symptoms are followed by a well-marked second, or paralytic stage, with muscular weakness, and incoordination and motor paralysis, though sensation is not lost, but is, in a measure, diminished. Stupor, collapse, with feeble pulse, cold surface, and shallow, weak respiration supervene, and death takes place by exhaustion of the powers upon which the circulation and respiration depend, asphyxia preponderating as a cause of death. Narcotism never occurs, and convulsions rarely. It will be observed that full medicinal doses cause a febrile state, while toxic doses paralyze. The rapidity of the heart's action is due first to stimulation of the sympathetic cardiac ganglia, and secondarily, to paralysis of the terminal filaments of the vagus—a state of increased motor activity with decreased inhibitory power. The capillaries are contracted, but in poisonous doses dilated, allowing a fall of blood-pressure, and being due to paralysis of muscular layers of the vascular coats. Owing to vaso-motor paresis, the temperature falls from toxic doses. Atropine causes mydriasis when taken internally by being carried in the blood-current directly to the eye and there acting, as when locally applied, by causing paralysis of the terminals of the oculo-motor nerve, and it is thought also by stimulating periphereal filaments of the sympathetic. Small doses of atropine, while probably causing primary dryness of the gastro-intestinal tract, subsequently induce secretion, as is shown by the slight laxative effects of it and belladonna. It also increases tissue waste, and is eliminated almost wholly by the kidneys; and the urine so charged is said to be capable of dilating the pupil of another subject. The voluntary muscles are but little or not at all affected by atropine. A livid or cyanotic countenance is seldom observed in poisoning by atropine. After death the heart, lungs, and brain are found to be overcharged with blood. The treatment in atropine poisoning is the same as for belladonna poisoning. One-half grain killed a middle-aged man, death singularly being delayed until the sixth day; 1 grain hypodermatically proved fatal to another (see *Belladonna*).

Medical Uses and Dosage.—As a general medicinal agent atropine may be used in cases requiring belladonna, governing the dose accordingly. Such uses will be those named under belladonna. However, it does not fully represent the parent drug. There are certain cases, however, in which atropine will be preferred; in some on account of its special adaptability; in others for its prompter action. It is a powerful stimulant to the vaso-motor centers and to the capillary circulation. It has at least four well-defined fields of action, viz.: to relieve purely nervous pain; to relieve painful spasm of the involuntary muscles; to arrest excessive secretion of saliva, perspiration, and milk; and as a mydriatic. In various forms of neuralgia, where the pain originates in some nervous disorder it acts magically. Thus it is useful, in the order named, in *intercostal*, *trigeminal*, and *sciatic neuralgia*. It often fails in the latter, and the dose must be large ($\frac{1}{50}$ to $\frac{1}{20}$ grain). In *neuralgia of the stomach*, *ovaries*, *uterus*, and in other *visceral neuroses* it is an efficient remedy. In most instances it should be subcutaneously employed. By combining it with morphine when this is subcutaneously injected (say $\frac{1}{96}$ of a grain of atropine) it prevents the faintness, nausea, and tendency to retching occasionally produced by the morphine alone.

Atropine sulphate, in from 2 to 4 per cent warm solution, has been instilled into the ear for the relief of pain in *earache*, *non-suppurative otitis media*, and in *diffused inflammation of the aural canal*. Atropine is specifically antagonistic to excessive secretions of saliva and sweat, hence it is of much value in *ptyalism* and in the *colliquative sweats of phthisis*, *hectic* and other conditions of *debility*. The dose should be about $\frac{1}{100}$ grain. The value of both belladonna and atropine is well established as remedies to check the *mammary secretions*. Hence it is used both locally and internally. Atropine sulphate gives prompt relief to *spasm* of the sphincters and tubular organs of the body.

It is chiefly in ophthalmic practice that atropine has gained laurels. It has, however, been objected to on account of the conjunctival irritation and œdema, as well as the dangerous ocular tension sometimes produced, which may imperil the safety of the eye. More recently it has been replaced, to a considerable extent, by homatropine, which is said to be free from some of the disadvantages attending the use of the former.

Sulphate of atropine in solution is preferred to any other salt of this alkaloid for *paralyzing the power of accommodation*, and for *dilating the pupil of the eye*, whenever such dilatation is required; but for this purpose the salt must be pure and perfectly free from acid or alcohol, else it is apt to occasion more or less irritation. That made according to the preceding formula with ether will be found advisable. The habit of ordering a solution of atropine, to which a few drops of sulphuric acid are to be added, is objectionable on the above account, when it is designed for application to the eye. An atropine gelatin has been made for the purpose of dilating the pupil, and which is preferred by some oculists to the solution. It consists of a thin layer of gelatin, with which has been mixed some sulphate of atropine. This layer is marked out into discs or squares, each one of which contains about $\frac{1}{1000}$ of a grain of sulphate of atropine. One of these discs placed upon the eye, between the ball and the lid, dissolves rapidly and causes dilatation. When it is desired to paralyze the power of accommodation it is prepared of greater strength (see also *Lamellæ Atropinæ—Br.*). It is largely used where inspection of the interior of the globe is sought, and in such operations as *cataract*, etc. It is a very valuable agent, but may do irreparable injury if inappropriately used. *Glaucoma* always contraindicates it, and in old people more or less danger attends its use, and even glaucoma may result from it. It is also contraindicated in *phlyctenular keratitis* after subsidence of the acute phases; in *marginal corneal ulcers;* in *keratitis* with superficial vascularity, and in all cases of *over-tension of the ocular globe*. On the other hand, it is the remedy in *iritis*, from start to finish, and in *central perforating corneal ulcers* it should be used sufficiently strong and often to insure continuous ciliary paralysis, thereby insuring full dilatation of the pupil, and in the latter instance preventing the iris from adhering to the ulcerated cornea. After operations for *cataract*, *iritis*, as a complication, is averted by the use of atropine, and it should be employed also in *deep*, *interstitial keratitis*. *Intermittent strabismus* and consequent *eye-strain*, as well as *chorea* from eye-strain, have been corrected by this drug, followed by the selection of the proper lenses.

In the *acute* stage of *phlyctenular keratitis* it may be employed to check the flow of tears and sensitiveness to light, discontinuing the drug as soon as the active inflammation has been subdued. Haziness of the cornea in *ophthalmia neonatorum* is the danger signal in this trouble, and the prompt use of atropine sulphate will prevent involvement of the corneal and deeper structures of the eye. As an eye remedy it may be used as the exigencies of the case demand. Foltz uses, ℞ Atropine sulphate, grs. ss to grs. xvi; water, add fl℥i, the stronger solutions to be used by the physician himself. A solution not stronger than 4 grains to the ounce is dispensed, to be used by the patient 3 times a day. Dilatation is produced in 10 or 15 minutes, and usually persists for 3 or 4 days.

Both atropine and belladonna are antagonistic to *opium poisoning*, and have been used as strong as $\frac{1}{12}$ grain every hour for 5 hours. It is also antagonistic to *eserine* and *pilocarpine*, and has been successfully used in *strychnine poisoning* and *chloroform* and *ether narcosis.* Frazer used it ($\frac{1}{120}$ to $\frac{1}{60}$ grain) with morphine sulphate ($\frac{1}{8}$ to $\frac{1}{12}$ grain) hypodermatically before anæsthetizing with chloroform, claiming that it lessens the excitement, takes less chloroform, and longer sustains the action of the latter. Sulphate of atropine ($\frac{1}{100}$ grain) placed directly upon the sensitive pulp of a tooth is said to promptly check the pain, and a solution has been applied to *cancerous ulcers* to allay pain. Sulphate of atropine, on account of its greater solubility, is preferred to atropine itself, and both are given in the same-sized doses, $\frac{1}{200}$ to $\frac{1}{20}$ grain, the larger doses only in extreme cases, as in narcotic poisoning. The solutions should be fresh, as they are apt to develop fungoid growths, with decomposition of the alkaloid. An ointment containing 3 grains of atropine sulphate rubbed upon an ulcer of the neck is said to have produced death in 2 hours.

Sulphate of atropine is generally used in solution in hypodermatic injection, the quantity injected at a time varying from $\frac{1}{50}$ to $\frac{1}{100}$ of a grain of the salt. The solution may be made by dissolving 1 grain of the sulphate in 4 fluid drachms of distilled water; 4 minims of this contain $\frac{1}{60}$ of a grain of the salt; the amount to commence with is 2 minims, which may be cautiously increased to 3 or 4 minims.

Dr. A. Fleming preferred the following solution of atropine for internal use: Take of atropine, 1 grain; distilled water, 5 drachms. Dissolve thoroughly with the aid of a few drops of diluted hydrochloric acid, and add of rectified spirit sufficient to make 10 drachms. This solution keeps well, is of uniform strength, and is much safer and more efficient than some other preparations of belladonna. Ten minims contain $\frac{1}{60}$ of a grain of atropine, which is the commencing dose for an adult; it should be given in a little water, once daily, at bed-time, and *on an empty stomach.* The dose may be increased daily by 2 or 4 minims until some of the physiological effects are slightly produced, as dry throat, dilated pupil, and dim sight. For children under 1 year the dose is 1 minim; of 2 years, 2 minims; of three years, 3 minims, and so on up to ten years, when 10 minims may be given. It is, however, too dangerous, as an internal medicine, for children, minute doses of belladonna being preferable. Atropine should never be given in pill form, lest from slow or deficient solution it may accumulate in the stomach or bowels, giving rise to severe atropism.

Related Salts of Atropine. — ATROPINÆ VALERIANAS. *Valerianate of atropine* may be made by dissolving a sufficient quantity of monohydrated valerianic acid in a sufficient quantity of pure ether, saturating this solution with atropine, and allowing the liquid to spontaneously evaporate. The salt is deposited in the form of light, white scales, consisting of a mass of small crystals, which is very soluble in water, less so in alcohol or ether, which fuses at 32.2° C. (90° F.) and becomes yellow by exposure to light and air.

M. Michea recommended the valerianate of atropine in *spasmodic* or *convulsive diseases*, in doses of a milligrame per day for an adult, on commencing its use; he considered it superior to either valerian or belladonna, on account of its small dose and its certainty of action. It is also recommended in various *chronic nervous complaints.* The dose is $\frac{1}{60}$ to $\frac{1}{250}$ of a grain, repeated 2 or 3 times a day.

ATROPINÆ SALICYLAS.—*Salicylate of atropine* forms in deliquescent, non-crystalline, colloidal masses, soluble in water and alcohol, and must be kept in securely-stoppered bottles. It may be prepared by taking a little more than 2 parts (288 grains) of atropine and 1 part of salicylic acid (137 grains) and dissolving them in water (20 ounces), and gently evaporating the solution. When pure it is reputed to act more efficiently and with greater rapidity than sulphate of atropine. The dose is the same as for the latter salt.

ATROPINÆ SANTONICUM.—*Atropine santonate* is formed by the union of atropine and santonic acid. It forms an amorphous powder unaffected by atmospheric moisture, but dissolves with facility in water, forming a solution which, if kept in amber-colored vials (prevents formation of photo-santonic acid), undergoes no change, hence its advantage over the other salts of atropine. Another advantage is that it is said to be perfectly unirritating.

For *Scopoline* see *Related Products*, under *Belladonna*; see also *Homatropine hydrobromate*.

Related Species and Principles.—*Ephedra vulgaris*. Japan. A plant of the order Gentianæ, from which Nagai of Tokio isolated the alkaloid *ephedrine* ($C_{10}H_{15}NO$). The latter body produces death in the lower animals by both cardiac and respiratory paralysis. It is a local mydriatic, producing, in 10 per cent solution, an incomplete dilatation of the pupil in from ½ to 1 hour, the normal condition being regained in from 6 to 20 hours. The accommodation is scarcely affected. It is not likely to come into general use.

Ephedra monostachya, Linné.—Root and branches used in Siberia in *syphilis* and *gout*. The alkaloid, according to Kobert, is non-toxic and non-mydriatic, and therefore unlike *ephedrine*. This view is supported by P. Spehr (*Amer. Jour. Pharm.*, 1892), who finds the alkaloid to be distinct with the composition $C_{13}H_{19}NO$, while that of ephedrine is $C_{10}H_{15}NO$.

Ephedra antisyphilitica, C. A. Meyer.—*Mormon tea*, *Mountain rush*, *Whore-house tea*, *Brigham weed*. Nevada. Used in *gonorrhœa* in doses of 1 to 2 fluid drachms of the fluid extract. The medicinal activity depends, in the opinion of Loew, upon a tannin.

GLEDITSCHINE.—Dr. Lautenbach (1878) found this alkaloid in the *Gleditschia triacanthos* and *Gleditschia ferox*. The same alkaloid was afterward introduced under the name *stenocarpine* before it was known to be the product of *G. triacanthos*. The former name was then restored. The alkaloid was introduced as a local anæsthetic and mydriatic. A solution at one time upon the market was shown to contain cocaine in considerable amounts, besides some atropine or a similar mydriatic, since which gleditschine has fallen into disrepute.

TETRAHYDRO-B-NAPHTHYLAMINE ($C_{10}H_7H_4.NH_2$).—An extraordinarily powerful local mydriatic, said to be even more powerful than atropine. A 1 to 5 per cent solution is used (Filehne).

AURANTII AMARI CORTEX (U. S. P.)—BITTER ORANGE PEEL.

"The rind of the fruit of *Citrus vulgaris*, Risso"—(*U. S. P.*) (*Citrus Aurantium*, var. *amara*, Linné; *Citrus Bigaradia*, Duhamel).

Nat. Ord.—Rutaceæ.

COMMON NAMES: *Bitter orange, Bigarade orange, Seville orange.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 50.

Botanical Source.—The bitter orange tree is scarcely distinguishable botanically from the sweet orange tree (see *Aurantii Dulcis Cortex*), except in its leaves, fruit, and flowers. The leaf stalk of the bitter orange is more broadly winged, and the fruit itself of deeper hue of red, having a rougher rind, and a bitter, sour juice. Added to these characteristics all portions of the bitter orange emit a greater fragrance than the same parts of the sweet variety. By some botanists this tree is regarded merely as a variety of the *Citrus Aurantium* of Linné (see *Aurantii Dulcis Cortex*).

Description.—I. THE RIND (*Aurantii amari cortex*). The *U. S. P.* describes bitter orange peel as consisting of "narrow, thin bands, or in quarters; epidermis of a dark, brownish-green color, glandular, and with very little of the spongy, white, inner layer adhering to it; it has a fragrant odor, and an aromatic, bitter taste"—(*U. S. P.*). (For further information regarding bitter orange, see *Aurantii Dulcis Cortex*.) It is official in *Extractum Aurantii Amari Fluidum* and in *Tinctura Aurantii Amari* of the *U. S. P.*

II. THE FRUIT (*Fructus aurantii*), when ripe, is about the shape and size of the common sweet orange, is darker in color, rougher, and has a white parenchyma beneath the rind, and the juice of the pulp is bitter and sour. Orangettes (*petit grains*) are the unripe fruits which drop from the trees, and are considerably used on the continent under the name of *orange berries*. They vary from ⅛ to ½ inch in diameter, are of a greenish or brown-black color, closely wrinkled, and pleasantly aromatic both in taste and odor.

III. THE LEAVES (*Folia aurantii*).—These are borne on a jointed, broadly-winged petiole, and are smooth, oblong-ovate or ovate, nearly entire, or having a slightly crenated margin. They are aromatic and have pellucid oil-glands scattered throughout the blade.

Chemical Composition.—A bitter crystalline body was isolated in 1828 by Lebreton and named *hesperidin*. It exists in the white parenchymatous tissues of both the orange and lemon rind, but is found in greatest abundance in the unripe Seville orange. It occurs, when purified, in white, acicular crystals, practically insoluble in water, even when hot. (1 in 5000 of boiling water). It dissolves in boiling acetic acid and in alcohol, but refuses to dissolve in ether, fats, essential oils, and benzol. Treated with diluted acids it is split into grape-sugar and *hesperetin*, insoluble in alcohol. Hesperidin fuses at 245° C. (473° F.); hesperetin at 223° C. (433.4° F.). A substance analogous to tannin, gum, resin, albumen, fixed oil, and an essential oil (see *Oleum Aurantii Corticis*) have also been found in the rind.

The juice of the orange consists chiefly of sugar, mucilage, and citric acid. Tanret (1886) found in bitter orange peel a bitter, acrid resin, a crystallizable, tasteless acid having the formula $C_{44}H_{28}O_{14}$, hesperidin, an isomeric glucoside (*isohesperidin*, $C_{44}H_{26}O_{24}.5H_2O$) and another glucoside (*aurantiamarin*), to which he attributes the bitterness of the rind on account of its solubility in water.

Action and Medical Uses.—(See *Aurantii Dulcis Cortex.*)

AURANTII DULCIS CORTEX (U. S. P.)—SWEET ORANGE PEEL.

"The rind of the fresh fruit of *Citrus Aurantium*, Linné"—(*U. S. P.*) (*Citrus dulcis*, Link).

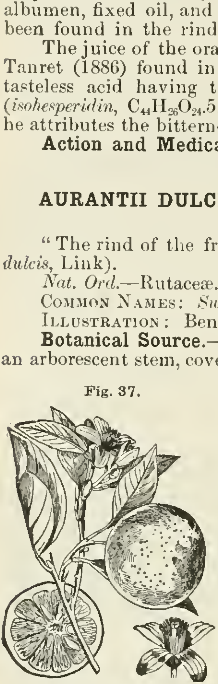
Nat. Ord.—Rutaceæ.

Common Names: *Sweet orange, Portugal orange, China orange.*

Illustration: Bentley and Trimen, *Med. Plants*, 51.

Botanical Source.—Citrus Aurantium is a middle-sized evergreen tree, with an arborescent stem, covered with bark of a greenish-brown color, having axillary spines on the branches. The leaves are alternate, ovate-oblong, acute, slightly serrulated or entire, shining green, the stalk more or less winged. The flowers are large, white, rendering the atmosphere around very fragrant; the calyx urceolate and 5-cleft: the petals 5, oblong; the stamens 20 or even more; the filaments compressed at the base, more or less united there, and polyadelphous; the anthers oblong and yellow. The ovary is many-celled. The fruit is roundish, golden-yellow or tawny, and several-celled, with a fleshy, juicy pulp; the seeds white and several. The cysts in the rind are convex (L.).

Fig. 37.



Citrus Aurantium.

Description, History, and Chemical Composition.—The orange is a native of Asia, and is cultivated in the southern parts of Europe and America and in the West Indies. Its varieties are numerous. The fruit likewise varies in its character, that of the *C. Aurantium*, the China orange, being sweet, while that of the *C. vulgaris*, the Seville orange, is acid and slightly bitter. The ordinary commercial oranges are subvarieties of the sweet orange, and usually take their names from the country where grown, or the shipping ports from which they are sent out. Some varieties are seedless, as *St. Michael's orange*, and generally the *Navel orange* of Brazil; another variety having a reddish pulp is known as the *Blood orange* or *Maltese orange*. The *Mandarin orange* differs considerably from the common orange, and on account of its delightful fragrance and flavor the name *Citrus deliciosa* has been proposed for it by those who regard it as a distinct species.

The leaves of the orange are studded with vesicles containing volatile oil, and have a bitter, aromatic taste, and when rubbed between the fingers are very redolent. They, together with the young twigs, yield by distillation an oil termed *essence de petit grain.* The original oil bearing this name was distilled from orange berries. It does not differ chemically from orange-oil, though it has a different odor. An infusion of the leaves is sometimes employed as a gently-stimulant diaphoretic. The flowers have a delicious fragrance, which is imparted to the surrounding atmosphere, but which is lost by drying; those of the bitter orange are considered the most delicate. They owe their aroma to an essential oil, which may be obtained by distillation; it is termed *oil of neroli*, and is much used in perfumery. An *orange flower water* is prepared in Italy and France, which is quite pale, has a rich odor of the flowers, and a bitterish, aromatic taste; it is employed for the purposes of perfumery, although reputed to possess antispasmodic virtues. The peculiar fragrance of the flowers may be preserved for a long time by beating them into a pulp with one-fourth their weight of common salt. The juice of the orange consists chiefly of sugar, mucilage, and citric acid. The outer rind of the mature fruit is the official part, the inner being destitute of useful properties, and the two should always be separated from each other when drying the rind for medicinal purposes, as the spongy, inner rind is apt to occasion moldiness from its absorbing moisture from the air. Orange-peel has a deep orange color, a grateful aroma, and a pleasantly bitter taste, the Seville variety being more bitter than any other. It contains a volatile oil in visible vesicles, mostly lost in drying, a saccharine principle, *hesperidin*, and a ligneous fiber, agreeing in composition with bitter orange peel, though containing a lesser amount of the bitter principle. The fresh rind, grated and expressed, will yield the volatile oil, or it may be obtained by distilling the fresh rind with water. Water or alcohol takes up the sensible properties of the rind. The finest orange oil, which must not be confounded with the oil of neroli, is obtained from Portugal, and is prepared from the rind of the sweet orange. It has a pale straw tint and a rich fragrance of the rind. It is imported in tinned copper cans, and is much used in perfumery and for other purposes. On exposure it spoils rapidly, acquiring a turpentine odor. When about the size of a pea or cherry, the bitter fruit is sold under the name of *orangettes*, that variety coming from the isle of Curaçao being known as *Curaçao oranges;* and the small ones are sometimes used to maintain the discharge from issues. The *U. S. P.* describes the official drug as "closely resembling bitter orange peel, but having an orange-yellow color. It has a sweetish, fragrant odor, and an aromatic, slightly bitter taste." It is used in the preparation of *Syrupus Aurantii* and *Tinctura Aurantii Dulcis* of the *U. S. Pharmacopœia*.

Test.—A test to distinguish orange peel from lemon peel was recently proposed by E. G. Clayton. It consists in moistening the rind with strong hydrochloric acid. The orange peel is stated to acquire a rich, dark-green tint, while lemon peel assumes at most a dingy, yellowish-brown color (*Amer. Jour. Pharm.*, 1894).

Action, Medical Uses, and Dosage.—Orange peel is aromatic and slightly tonic, but is seldom used except to cover the taste of disagreeable medicines or to lessen their tendency to nausea, and for these purposes it is frequently added to bitter tinctures, infusions, etc., as quassia, Peruvian bark, etc.; though care should be taken not to subject it to long boiling on account of its oil, which will thus be dissipated. As a tonic the rind of the Seville orange is preferred; its dose in substance is from 30 to 60 grains 3 times a day. Large quantities of it have caused violent colic, convulsions, and even death. The juice of the orange is not only a light refrigerant article of diet, but has a direct beneficial medicinal influence in several diseases; as in all *fevers* and *exanthematous diseases*, where acids are craved, and the patient's tongue is coated deep-red, brown, black, or any intermediate color; in such cases its free use may be allowed with advantage; it is also useful as an antiscorbutic in *scurvy*. In administering the juice the membraneous portion should always be carefully rejected (see also *Aurantii Flores*).

AURANTII FLORES.—ORANGE FLOWERS.

The fresh flowers, partially expanded, of *Citrus Aurantium*, Linné, and *Citrus vulgaris*, Risso.

Nat. Ord.—Rutaceæ.

Description.—Orange flowers are composed of a small, cotyloid, 5-parted calyx and 5 white, fleshy, oblong, obtuse petals, which are dotted here and there with glands. They are about ½ inch in length. The filaments of the stamens, which are about 20 in number, are united below into bundles (3, sometimes more). The ovary, which is globular, rests on a disk, and is surmounted with a round style, capped with a globe-like stigma. The odor of orange flowers is exceedingly and pleasantly fragrant, the bitter variety possessing this quality more than the sweet orange. They have an aromatic, bitterish taste. When dried the petals are of a pale, brown-white color. The flowers may be preserved for some time by adding to them half their quantity (by weight) of common salt, and pressing them into a jar, which should then be securely closed and kept in a cool, dark situation.

Chemical Composition.—Orange flowers contain an essential oil (see *Oleum Aurantii Florum*), acetic acid, gum, salts, and bitter extractive (Boullay, 1828); the bitterness of the latter is thought to be due to *hesperidin* (see *Aurantii Amari Cortex*).

Action, Medical Uses, and Dosage.—Orange flowers are used in the preparation of orange-flower water, which may be employed as a vehicle for the administration of medicines. It is slightly stimulant to the nervous apparatus, and is said to have proved beneficial, in doses of 1 or 2 fluid ounces, in *chorea*, *hysteria*, *epilepsy*, and many other *nervous disorders*.

AURI ET SODII CHLORIDUM (U. S. P.)—GOLD AND SODIUM CHLORIDE.

"A mixture of equal parts, by weight, of dry gold chloride ($AuCl_3$=302.81) and sodium chloride (NaCl=58.37). It should be kept in well-stoppered vials"—(*U. S. P.*).

SYNONYM: *Chloride of gold and sodium.*

Preparation.—1. Dissolve 4 parts of gold in nitro-hydrochloric acid, evaporate the solution to dryness, and treat the dried mass with 8 times its weight of distilled water containing in solution 1 part of well-dried, common salt. Evaporate the solution nearly to dryness, stirring all the time with a glass rod (Figuier). 2. Dissolve 85 parts, by weight, of chloride of gold (auric trichloride) and 16 parts of chloride of sodium in a small quantity of water; evaporate the solution by a gentle heat until a pellicle forms, and then put aside to crystallize. As prepared by the French from proper proportions of solutions of auric trichloride and sodium chloride, and evaporated to crystallization, it forms in yellowish-red, permanent rhombic crystals of the composition $NaCl.AuCl_3.2H_2O$. In this country it is most generally prepared by dissolving equal weights of gold chloride and sodium chloride and evaporating to dryness.

Description and Tests.—The crystallized double salt is in the form of prismatic, quadrangular, and elongated crystals, of a very bright-yellow color, permanent in the air, unless they contain uncombined trichloride, when they are slightly deliquescent. They are soluble in water. When heated they give out water, and then melt, and at a red heat give out chlorine; but it requires a very long-continued application of heat to drive off the whole of the chlorine. The salt more generally employed is that of the *U. S. Pharmacopœia*, which should agree with the following description and tests: "An orange-yellow powder, odorless, having a saline and metallic taste, and slightly deliquescent in damp air. The compound is very soluble in water, and at least one-half of it should be soluble in cold alcohol. When exposed to a red heat it is decomposed, and metallic gold is separated. A fragment of the compound imparts a persistent, intensely-yellow color to a non-luminous flame. Its aqueous solution has a slightly acid reaction, and yields, with silver nitrate T.S., a white precipitate insoluble in nitric acid. On bringing a glass rod, dipped into ammonia water, close to a portion of the compound, no white fumes should make their appearance (absence of free acid). If 0.5 Gm. of gold and sodium chloride be dissolved in 50 Cc. of water in a porcelain capsule, the solution acidulated with 5 Cc. of diluted sulphuric acid, and, after the addition of 1 Gm. of pure oxalic acid, heated for about 2 hours on a water-bath, a precipitate of metallic gold will be obtained, which, when washed, dried, and ignited, should weigh not less than 0.15 Gm. (corresponding to at least 30 per cent of metallic gold). The filtrate from the precipitated gold should not be affected by hydrogen sulphide T.S., nor, after being supersaturated with ammonia water, by ammonium sulphide T.S. (absence of metallic impurities)"—(*U. S. P.*). Of all the preparations of gold, this is the most to be relied upon. When taken into the system, being a soluble salt, it is excreted and passed off by the skin and kidneys, principally the latter. It is incompatible with most vegetable and mineral acids, earths, most vegetable juices, and the oxides or salts of other metals. The simpler the form in which it is prepared for administration, the less liability will there be of its decomposition.

Action, Medical Uses, and Dosage.—The salts of gold closely resemble those of mercury in their effects upon the human system. The chloride of gold is caustic, and even more poisonous than corrosive sublimate. An erethism, not unlike the fever of mercurialism, is said to be produced by its long-continued use, and the sexual functions are said to be stimulated by gold preparations. Bromide of gold is twenty or more times as powerful as the commonly employed bromides. The chloride of gold and sodium has been found by Bartholow to have a marked action when long continued in causing a waste of connective tissue, a fact taken advantage of in certain diseases characterized by an over-abundance or over-production of that tissue.

Among the effects of auric preparations are the following: Small medicinal doses promote the appetite and digestion, but their long-continued use induces constipation. Full doses occasion gastric irritability, nausea, and anorexia. Long continued they produce a fever (auric fever) with colliquative sweats, marked diuresis, and ptyalism, differing, however, from mercurial ptyalism in not producing tenderness or ulceration of the gums. The mind becomes active under auric medication, and may be excited, followed by cheerfulness. Among the earliest uses of gold we find it principally a remedy for mental disorders. Increased sexual desire in the male, with erections, amounting sometimes to priapism, takes place, while both sexual desire and the menstrual function are augmented in the female. The preparations are chiefly eliminated by the kidneys, though to some extent by the skin and bowels. Over-doses of the gold salts are to be treated with the same antidotes as for the mercury compounds.

Gold was formerly employed in the form of the triturated leaf in many of the conditions in which the so-called double chloride is now employed. The chloride of gold and sodium in small medicinal doses is endowed with general stimulant and diuretic properties, acting also as an energetic alterative. It has been highly recommended in primary and secondary *syphilis*, *scrofulous* and *herpetic affections*, *goitre*, *scirrhous tumors*, *ophthalmic affections*, *dropsy*, etc. It is principally used among Eclectic physicians as an antisyphilitic, and as such it is of decided efficacy. In four cases where some of the virus from chancres had accidentally lodged in the eye, producing symptoms threatening a loss of that organ, I saved the eyes by bathing them several times a day, with a wash made by dissolving 7 grains of the chloride of gold and sodium in a fluid ounce of distilled water, likewise using the salt internally (J. King). The cases in which gold and sodium chloride acts favorably are those showing a moderately red tongue and fair surface-circulation in *secondary syphilis*, *glandular affections*, and in certain *chronic skin diseases*. The tongue is contracted more than ordinarily, and the symptoms are secondary or tertiary. When *chancres* and *buboes* are present they are indolent and of the non-sensitive variety. The dose should be small—$\frac{1}{60}$ to $\frac{1}{12}$ grain in pill.

Of recent years gold and sodium chloride has been quite extensively used in certain *mental disorders* and *bone diseases*. This use has been borrowed from homœopathy, and the strength of preparations used is the 3 x to 6 x triturations. A keynote for the use of the drug in these attenuations seems to be a melancholic state of mind, with despondency and desire for death or disposition to suicide. These indications are all the more strengthened if the individual be one whose system is shattered with syphilis. Thus this salt, as well as the arsenate of gold, has been used in the *chronic headaches* dependent upon *syphilitic periostitis*, *ozena*, and *bone necrosis*, especially in *caries of the nasal bones*, for which it appears to have a selective affinity. From the earliest times gold has been known as an efficient remedy for *hypochondriasis*, and this action has been put to good use by homœopathists. The mental and nervous disorders in which it may be employed are *insanity* from sexual excesses, *melancholia*, with suicidal mania, and *hypochondriasis*, due to disorders of the testes or liver. *Chronic bone-pains*, *pericranial* and *periosteal pain*, and *neuralgia* are cases for it, particularly when a syphilitic taint is present. Where the neuralgic element is strong the arsenate is preferred. Diseased states arising from the abuse of mercury, as in *ulceration of the throat*, are to be treated with this drug.

That gold and sodium chloride would increase waste of connective tissue led Bartholow and others to employ it, where it was desired to prevent the over-production of that tissue—*hyperplasia* in any organ. Thus it has been used in *chronic interstitial nephritis*, and other like affections, in $\frac{1}{20}$ grain doses. *Uterine* and *ovarian indurations* are reduced by it (3 x trituration). *Chronic sexual disorders*, with involvement of the structures, are thought to be benefited by its use. Among these troubles are *erotomania*, *nocturnal pollutions*, *premature emissions*, and *sexual irritability*, as well as *testicular atrophy* after *epididymitis* and *sarcocele*.

In ophthalmic and aural practice it is said to be efficient where the iodides are not well received. *Caries of the orbit* of scrofulous nature, *deep keratitis* from hereditary syphilis, and the *iritis* and *keratitis* of acquired syphilis are disorders in which it is of service (Foltz). Dose, $\frac{1}{100}$ grain. In ear diseases Foltz finds it of value in such cases as depend upon *hereditary syphilis*, but of little value in acquired syphilis. He claims brilliant success from its use in *suppurative otitis media*, where caries is a prominent feature. Dose, $\frac{1}{200}$ to $\frac{1}{100}$ grain every 4 hours. (For the further use of this drug in minute doses, see Webster's *Dynamical Therapeutics*.)

The dose of gold and sodium chloride internally is from $\frac{1}{12}$ to $\frac{1}{30}$ of a grain, which may be given in pill form or in solution, thus: Dissolve 2 grains of chloride of gold and sodium in a fluid ounce of water, of which the dose is 10 or 15 drops every 2 or 3 hours. For pills mix 2 grains of the salt of gold with 1 drachm of powdered starch, lycopodium, or orris root, and form into a pill mass with a sufficient quantity of gum Arabic in solution; divide into 40 pills, each of which contains $\frac{1}{20}$ of a grain of the gold salt. Or it may be given in powder made by rubbing together 1 grain of the salt with 1 drachm of white sugar, or sugar of milk, and dividing into 12, 15, or 20 powders, according to the dose required. It has, however, been given in doses of from $\frac{1}{6}$ to $\frac{1}{2}$ grain, 3 times a day, and without any unpleasant consequences; but when such doses are prescribed its action should be carefully watched, and its administration be suspended for a time. Its effects upon the system in over-doses, or when the patient contracts cold while under its influence, are said to be equally as severe and dangerous as those following the use of corrosive sublimate, under the same circumstances. The 3 x and 6 x triturations are given in 2 or 3-grain doses 3 or 4 times a day. Externally it may be applied to scrofulous and syphilitic *ulcers* in solution, or made into an ointment with prepared lard, in the proportion of 7 or 9 grains to the ounce of water or lard.

Specific Indications and Uses.—Tongue contracted and redder than usual, syphilis, especially in secondary and tertiary stages, and in the hereditary form; non-sensitive and indolent buboes and chancres ($\frac{1}{60}$ to $\frac{1}{12}$ grain). Melancholia, with suicidal propensity, depressed spirits, hypochondriasis, and troubles associated with these symptoms; syphilitic caries (3 x trituration).

Gold and Its Compounds.—AURUM. Symbol, Au. Atomic weight, 196.2. **Gold is the** chief of the precious metals, as well as being the most ductile of metallic substances. It is the only element having a bright-yellow hue, and is named from its lustrous, shining color. It is found naturally in the earth free and combined. It exists in sea water, and is occasionally met with as an amalgam. *Moss* gold is native gold, the crystals of which are so arranged as to resemble golden threads. Gold is obtained in the mining districts by agitating the crushed earthy material with water, whereby the heavier gold falls to the bottom, and is then dissolved from the mineral admixtures by agitation with mercury. The amalgam thus obtained is then distilled, whereby the mercury passes over and the gold remains behind. Of late years advantage is taken of the solubility of gold in potassium cyanide to extract gold from poor ores. Such ores could not be worked at all by the old process. Some idea of the ductility of gold may be gathered from the following statement from Lloyd's *Chemistry*, that when hammered "280,000 thicknesses of gold-leaf will only occupy 1 inch in thickness, and 1 grain of gold will gild 2 miles of silver wire."

Gold may be so finely attenuated that the precipitate will remain suspended in water, even though its density is much greater than that of the latter. According to Matthiessen its specific gravity is 19.265. It is wholly unaffected by oxygen or water, nitric and the other concentrated mineral acids should have no action on it, nor should ammonia tarnish it. Nitrohydrochloric acid (aqua regia), however, dissolves it readily and completely, nascent chlorine being the agent which accomplishes its solution. Pure gold is too soft for coin and trinkets, hence it is generally alloyed with copper or silver, the former imparting to the alloy a reddish tint, while the latter occasions a pale-yellow hue. With mercury it forms an amalgam. In making and selling jewelry the term *carat* is employed, pure gold being represented by "24 *carat*"—an "18 carat" gold, for example, meaning an alloy of 18 parts of gold and 6 parts of copper or silver. The chief salt of gold used in medicine is tbe chloride in the combination of gold and sodium chloride.

Aurum Foliatum.—*Gold-leaf* is a transparent, bluish or greenish film, used sometimes as a *pill-coating*.

Auri Pulvis.—*Pulverized* or *powdered gold*. This may be made by triturating until lustreless a quantity of gold-leaf with some gritty substance like milk-sugar, or other hard crystalline substance which is soluble. The gold is washed with water.

Auri et Ammonii Chloridum.—*Gold-ammonium chloride*. This salt resembles auric chloride, and is made by dissolving in water equal amounts of gold chloride and ammonium chloride, hydrochloric acid being added to acidulate the solution; and finally evaporating to dryness.

Auri Chloridum.—*Auric trichloride, Chloride of gold* ($AuCl_3$). Dissolve gold coin in nitro-hydrochloric acid, evaporate to dryness, dissolve the residue in water, and pour the solution into an excess of ferrous sulphate. Metallic gold is thrown down as a black precipitate. Wash the precipitate well, dissolve in nitro-hydrochloric acid, and evaporate to dryness. Dissolve the residue in a little water, and again evaporate to dryness and place the product at once in well-stoppered bottles. This salt in mass is dark-red, but yellowish-red when powdered. It should have no greenish tinge, and should dissolve completely in water, alcohol, and ether (see Lloyd's *Chemistry*, p. 346). With solution of stannous chloride it forms "purple of Cassius," a deep, brownish-purple precipitate. Auric chloride is used in testing for alkaloids, with which it forms insoluble precipitates.

Auri Oxidum $Au(OH)_3$.—*Gold hydroxide, Auric acid* (so-called). A very dark, almost black-brown powder. This may be prepared by strongly alkalinizing with caustic potash a cold solution of auric chloride, and precipitating the solution with barium chloride. Aurate of barium results, and this, when treated with diluted nitric acid, leaves its barium in solution, and pure oxide of gold remains (M. L. Figuier). It may also be obtained by precipitating a solution of chloride of gold with magnesium oxide or zinc oxide, the precipitate being washed on a filter successively with diluted nitric acid and water. This does not give so large a yield as the preceding process.

Auri Cyanidum.—*Cyanide of gold*. A tasteless, odorless, lemon-yellow salt, prepared by adding to pure gold chloride in solution an equal quantity, by weight, of pure cyanide of potassium in aqueous solution. Should too much of the latter salt be employed a darker precipitate, which is not desirable, would be formed. This salt contains 75 per cent of metallic gold (Figuier's process). *Auro-potassium cyanide*, in colorless, plate-like crystals, may be produced by employing a strong, hot solution of cyanide of potassium in excess. It effloresces and becomes white on exposure to the air. It contains gold amounting to 55 per cent.

Auri Iodidum.—*Iodide of gold* (AuI_3). A deep-green powder, made by precipitating gold chloride from solution with iodide of potassium, taking the precaution not to have an excess of the potassium salt. Wash well with water and carefully dry the compound. When exposed to the atmosphere it liberates iodine, being successively converted into *aurous iodide* (AuI) and metallic gold. Potassium iodide solution dissolves it.

Aurum Bromidum.—*Gold bromide* is recommended by Hale (*Hom. News*) as a remedy for *somnambulism* in children, with *night terrors*, the child starting upon a run as if pursued. Third x trituration in 2 grain doses 3 times a day, the last at bedtime. The specific indications, according to Watkins (*Comp. of Ec. Med.*), are nervousness and apprehension, night terrors, sleep-walking, epilepsy. Two grains of 3 x trituration every 3 hours.

AVENA SATIVA.—COMMON OAT.

The seed of the *Avena sativa*, Linné, and a farina prepared therefrom.

Nat. Ord.—Graminaceæ.

Botanical Source.—Avena sativa, or the common oat, has a smooth stem, from 2 to 4 feet high, with linear-lanceolate, veined, rough leaves, with loose, striate sheaths; the stipules are lacerate; the panicle equal and loose; the spikelets pedunculate, pendulous, 2-flowered, both flowers being perfect, the lower one mostly awned; the paleæ are somewhat cartilaginous, closely embracing the caryopsis; the root is fibrous and annual.

History.—Oats have been noticed by the ancient Greek and Roman writers; at present they are cultivated in nearly all northern temperate latitudes. Their native country is unknown, though they are stated to be indigenous in Sicily and in a certain Chilian island. When the seed is stripped of all its teguments, including its innermost, silky, fibrous covering it constitutes *groats;* and when this is ground into fine meal or flour it is called *prepared groats*. When the seed is kiln-dried, stripped of its husk and delicate outer skin, and then coarsely ground it constitutes the oatmeal of Scotland, a common, farinaceous article of food for laboring people and children (C.). Many forms of "rolled oats" are now a general article of commerce, forming excellent cereal foods. Oats are largely cultivated in America as food for horses and cattle. American oatmeal is said to be inferior to the foreign preparations.

Chemical Composition.—Vogel found oats to contain 66 per cent of meal and 34 per cent of husk; the dried meal consists of starch, 59; saccharo-mucilaginous extract, 10.75; albumen, 4.3; oleaginous matter, 2; ligneous fiber and moisture, 24 (T.—C.). Other analyses have been made, which vary from the above in quantity and elements, showing oats to consist of a large proportion of starch, some sugar, gum, oil, albumen, gluten, a nitrogenous body, epidermis, alkaline salts, etc. M. Payen found oats to contain starch, 60.59 parts; gluten and other azotized matters, 14.39; dextrin, glucose, or congenerous substances, 9.25; fatty matters, 5.50; cellulose, 7.06; silica, phosphates of calcium, magnesium, and soluble salts of potassium and sodium, 3.25 (P.). A large proportion of the nitrogenous material consists of *avenin*, a body containing a large proportion of nitrogen to a small amount of oxygen (about 17 to 1). With solvents it behaves much like *legumin*, which it resembles. It may be obtained from oatmeal by treating the latter, at a low temperature, with a dilute solution of caustic potash, decanting the clear liquid and precipitating the impure avenin by means of acetic acid. To purify it wash it first with diluted alcohol; then, with concentrated alcohol, dissolve again in a dilute solution of potassium hydroxide, and treat again with acetic acid, when avenin will be precipitated (Kreusler).

Oatmeal.—AVENÆ FARINA. Oatmeal is odorless, or has but little odor, is not so white as wheat flour, and has a somewhat bitterish taste. Particles of the integument may be observed in it, and it contains the gluten of the oat. Its starch-cells are polyhedral, having a checkered appearance, and are usually aggregated into ovoid or subspherical masses, easily separable under pressure. It is insoluble in alcohol, ether, and the oils; but the first two remove an oleo-resinous matter from it. Water removes its nourishing principles when boiled with it.

Action, Medical Uses, and Dosage.—I. AVENÆ FARINA. Oatmeal is nutritive and demulcent. Good in *habitual constipation*, but not in dyspepsia accompanied with acidity of the stomach. In the form of gruel, either salted or seasoned with sugar, honey, or the pulp of fruit, it is an agreeable nutritive during *convalescence from acute diseases*, in the *puerperal* state and in some *chronic diseases*. Oatmeal made into a cake with water, baked and browned like coffee, then pulverized and made into a coffee, or infusion, forms a drink which will allay *nausea* and check *vomiting* in a majority of cases when all other means fail, and used thus is very useful in *diarrhœa*, *dysentery*, *cholera morbus*, and *irritable conditions of the stomach*. One ounce of oatmeal in 2 quarts of water, boiled down to 1 quart and then strained, forms a very nutritive gruel. It may be rendered more palatable by the addition of vegetable acids, aromatics, sugar, prunes, raisins, etc.

II. AVENA SATIVA.—This plant is a nerve-tonic, stimulant, and antispasmodic. It ranks among the most important restoratives for conditions depending upon *nervous prostration*, and for the *nervous exhaustion* consequent upon *typhoid* and other low *fevers*, and the accidental disorders arising from these complaints, as *weak heart*, *spermatorrhœa*, *insomnia*, etc. In *enfeebled states of the heart muscle* it acts as a good tonic to improve the energy of the organ, and is recommended by Prof. Webster to prevent *relapsing cardiac rheumatism*. In this condition it is not thought to be specially antirheumatic, but rather to strengthen that debility upon which the rheumatic diathesis depends, so that the patient is less subject to atmospheric and other impressions. In *spermatorrhœa* it is adapted to those cases of debility following adynamic diseases, or in simple spermatorrhœa when not due to self-abuse. The atonic state gives rise to a nervous erethism or an enervated condition favorable to nocturnal losses. In cases depending wholly or partially upon prostatic irritation it is of less value, but aids staphisagria, sabal, salix nigra aments, and other indicated remedies. *Spasmodic conditions of the neck of the bladder* are said to be relieved by it.

A few years ago it was much lauded as a remedy to assist the morphine-consumer to throw off the habit, and to sustain the nervous system while undergoing that ordeal. We have, however, found it to exert but little good in this direction. A strong tincture may be prepared by crushing or pounding to a pulp the entire oat-plant when the grain is "in the milk," covering with strong alcohol and allowing it to macerate 14 days. The dose is from 10 to 30 drops in hot water; specific avena, 1 to 20 drops every 2 or 3 hours; Keith's concentrated tincture, 1 to 25 drops. This remedy was introduced by B. Keith & Co.

Specific Indications and Uses.—Nerve tonic, stimulant, and antispasmodic. Spasmodic and nervous disorders, with exhaustion; cardiac weakness; nervous debility of convalescence; spermatorrhœa from the nervous erethism of debility; tensive articular swellings.

AZEDARACH.—AZEDARACH.

The bark of the root of *Melia Azedarach*, Linné.

Nat. Ord.—Meliaceæ.

COMMON NAMES: *Pride of India*, *Pride of China*, *Bead-tree*, *Indian lilac*, *African lilac*, and *Persian lilac*, a name properly belonging to *Syringa persica*.

Botanical Source.—This elegant tree, attains the height of 30 or 40 feet, with a trunk about 1½ feet in diameter, and divaricate branches. The bark is rough. The leaves are alternate and unequally bipinnate; the leaflets opposite, ovate, acute, serrated, sometimes incised, and in pairs with an odd one. Lilac-colored flowers are borne in terminal panicles, on axillary peduncles. The corolla consists of 5 petals, patent, pale-pink inside, deep-lilac outside; the calyx is 5-parted. Stamens with tube 10-cleft at top, deep-violet; anthers yellow. Ovary 5-celled; stigma 5-lobed; style columnar. The fruit is a drupe the size of a small olive, with one 5-celled, bony nut; the cells are 1-seeded (L.).

History.—This tree, although a native of several Asiatic countries, is cultivated in the warm climates of Europe and America; it does not grow to any extent north of Virginia, and flowers early during the spring. Its name of *Bead-tree* was derived from the use to which its hard nuts are put in Roman Catholic countries, viz.: for making rosaries. The recent bark of the root is the most active part for medicinal purposes. It has a disagreeably bitter taste, and a very unpleasant odor, and imparts its properties to water at 100° C. (212° F.), and to weak alcohol. A fluid extract might possibly be prepared from it for general use. Quite a quantity of alcohol may be obtained from the berries by fermentation. This drug was early used by the Arabs and Persians. In the East the flowers and leaves are used locally to cure nervous headache, and a poultice of the flowers is employed to destroy lice and cure scalp eruptions. The fruit, though poisonous, is given in scrofula and leprosy (Dymock, *Mat. Med. Western India*).

Description.—The commercial bark comes in curved or irregular pieces, or quills, which break with a somewhat fibrous fracture. They vary considerably in length and thickness; are reddish-brown externally, with irregular ridges running lengthwise, of a blackish color. The inner surface also has longitudinal markings, and is either whitish or light-brown in color. It has a sweetish, succeeded by nauseous, bitter taste, and is without odor. The bark of old roots has a thick, corky layer, of a rust-color, which must be removed if a good article is desired. It has scarcely any taste.

Chemical Composition.—Jacobs, in 1879, obtained the bitter resinous constituent of this bark, of a yellow-white color. It dissolves readily in alcohol, chloroform, and ether, and is but partially soluble in carbon bisulphide, turpentine, benzin, and water; scarcely at all in the last three. Its other constituents are thought to be similar to those of the *Azadirachta indica* (see below).

Action, Medical Uses, and Dosage.—The bark is anthelmintic, and in large doses narcotic and emetic. Kollock states that if gathered in the spring of the year, during the ascent of the sap, it will cause narcotic symptoms resembling those occasioned sometimes by spigelia. Among the effects of over-doses are dizziness, dimness of vision, confusion of the mind, tendency to syncope, vomiting, stertorous respiration, coma, pupillary dilatation, cold perspiration, and catharsis. It is useful in *worm fevers* and in *infantile remittents*, in which, although worms are absent, yet the symptoms are similar to those accompanying the presence of worms. Dose of the powdered bark, 20 grains; of the decoction (which is the best form for administration, 2 ounces of the bark to 1 pint of water, and boiled to ½ pint), 1 tablespoonful every 1, 2, or 3 hours till the desired effect obtains; a purgative should follow its employment. The fruit is somewhat saccharine, and is said to be an active anthelmintic; its pulp has been used in an ointment for destroying *lice* and other *ectozoa*, as well as in the treatment of *scald-head* and other *diseases of the skin.* By expressing the nuts an oil may be obtained which is said to possess anthelmintic properties, and to be useful as a local application to *rheumatic affections, cramps, obstinate ulcers*, etc. As an anthelmintic it has attained considerable reputation in our Southern States, where the bark may be obtained fresh.

Related Species.—*Melia Azadirachta*, Linné (*Azadirachta indica*, Jussieu). *Nim tree of India*, where it is cultivated extensively for medicinal use. The bark is a bitter, astringent tonic. The leaves are used in *glandular enlargements, pustular, cutaneous diseases*, and their juice as an anthelmintic. The fermented sap of the tree is employed as a stomachic. It is regarded reverentially by the superstitious natives, who believe that syphilis is cured by waving a ním branch in the air, and that the insane are cured by passing through an opening formed by reunion of the extremities of the parts of a cleft limb, or trunk of the tree. Hove found a decoction of the leaves useful in *liver disorders* and *intermittents.* The drug is official in the *Pharmacopœia of India* (see Dymock, *Mat. Med. of Western India*).

Margosa bark (*Ním bark*), as this drug is called, contains a substance considered as an alkaloid by Cornish (1856) and to which he gave the name *margosine.* It has a bitter taste, and was obtained only in exceedingly small amounts as a "double salt of margosine and soda," taking the form of long, white, acicular crystals (*Pharmacographia*). The composition of margosine and of *margosic acid*, obtained by the same experimenter from a bitter oil contained in the seeds, is unknown. Broughton (*Pharm. Jour.*, 1873) believed the bitter principle to reside in an amorphous resin having the formula $C_{36}H_{50}O_{11}$. He also obtained a crystalline principle of unknown character, which he, however, thought to be a fatty body, a view not participated in by Flückiger on account of its high melting point, 175° C. (347° F.) (*Pharmacographia*).

Melia dubia, Cav. India. The dried fruit is used by the poorer classes as a remedy for *colic*, the half of a fruit very effectually relieving the pain. The green fruit, with sulphur and curds, is employed in *scabies* (Dymock).

Soymida febrifuga, Jussieu (*Swietenia febrifuga*, Willdenow). *Nat. Ord.:* Meliaceæ. This is the *Rohuna* or *Rohun tree* of Hindustan, and is known on the Coromandel coast of India as *Redwood tree*, and is the only known species of the genus. The bark is very bitter and astringent, and was recommended by Roxburgh as a substitute for cinchona. It was admitted into the *Edinburgh Pharmacopœia* in 1803, and in 1807 into the *Dublin Pharmacopœia.* It is used as a tonic and also as an antiperiodic; but, according to Ainslie, if given beyond the extent of 4 or 5 drachms in 24 hours will derange the nervous system and occasion vertigo and subsequent stupor. It is said to have been employed in India with success in the treatment of *gangrene* (?); and in Great Britain as an astringent, and in the treatment of *typhus fever.* Waring, who has employed it, considers it to be a bitter tonic and not a febrifuge.

Swietenia Mahogoni, Linné. *Mahogany tree.* West Indies, Mexico, and the American tropical region. Yields the well-known wood, mahogany. Bark bitter and astringent; contains catechin.

Khaya senegalensis, Guillemin et Perrottet. Bark and wood similar to preceding; contains an alkaloid (Caventou). Used in Africa in *intermittents.*

Carapa guianensis, Aublet, and *Carapa Touloucouna*, Guillemin et Perrottet. Bark anthelmintic; seeds yield *crab, kundah,* or *callicoonah oil,* which is non-volatile and bitter.

BALSAMUM PERUVIANUM (U. S. P.)—BALSAM OF PERU.

"A balsam obtained from *Toluifera Pereiræ* (Royle), Baillon"—(*U. S. P.*). *Myrospermum of Sonsonate*, Pareira; *Myrospermum Pareiræ*, Royle; *Myroxylon Pereiræ*, Klotzsch; *Toluifera Balsamum* var. *Baillon.*

Nat. Ord.—Leguminosæ.

Common Names: (Tree) *Peru balsam tree;* (Balsam) *Balsam of Peru.*

Illustrations: Köhler, *Med. Pflanzen Atlas;* Bentley and Trimen, *Med. Plants*, 83.

Botanical Source.—A beautiful tree much resembling the *Toluifera Balsamum*, Miller, growing to a height of about 50 feet, the ramifications of its branches beginning low at a distance of from 7 to 10 feet from the ground and having both a spreading and ascending tendency. The young branches are covered with a smooth, gray, or purplish bark, beset with yellowish or white penticels. The alternate, petioled leaves are odd-pinnate, with from 7 to 11 leaflets. The leaf-stem, somewhat thickened at the base, and the base of the leaves are beset with a dense growth of very stout, yellow, reverse hairs. The leaflets are about 3 inches long and half as wide, lanceolate-ovate, rounded at base, pointed (the point being sometimes twisted), undulate, and folded at the edge. They are finely veined, and within the venation of the leaf-substance there occur more or less rounded or oblong, oil receptacles, transparent when held up to the light. The mid-rib is very prominent on the under-surface of the leaf. The flowers are numerous, hermaphrodite, and long-peduncled, in slender racemes. The fruit is an oblanceolate, indehiscent legume, about 2 to 4 inches long, and contains one seed, the mesocarp of which exhibits balsam receptacles, especially two oblong vittæ upon each side.

History and Collection.—Until recent years it has generally been believed that the tree yielding Peru balsam was the *Myroxylon Peruiferum* of Linné filius, a tree growing along the western coast of South America and in Brazil. Pareira (1850), however, showed that another species produced it, and provisionally named that species the *Myrospermum of Sonsonate*. Some authors, like Baillon, Carson, Ruiz, and others, regard the trees furnishing the balsams of Peru and Tolu as identical. Others, however, regard them as entirely distinct from each other. Flückiger and Hanbury, in *Pharmacographia*, make the following distinctions:

> "M. TOLUIFERA: Trunk tall and bare, branching at 40 to 60 feet from the ground, and forming a roundish crown of foliage. Calyx rather tubular. Racemes dense, 3 to 4½ inches long. Legume scarcely narrowed towards the stalk end."
>
> "M. PAREIRÆ: Trunk throwing off ascending branches at 6 to 10 feet from the ground. Calyx widely cup-shaped, shallow. Racemes loose, 6 to 7 inches long. Legumes much narrowed toward the stalk-end."

The Peru balsam tree inhabits the coast region of San Salvador in Central America. While the trees are found singly or in clusters in the forests, they are generally owned by certain individuals who control the collection of the balsam, which is done by the natives. The trees are in the sections known as the Indian Reservation Lands of the Balsam Coast. The flowers are said to be so fragrant as to be smelled at a long distance, even before one is in sight of the trees.

Dr. Charles Dorat, of Sonsonate, in a letter to Mr. Daniel Hanbury, gives the following account of the collection of Balsam of Peru:

"Early in the month of November or December, or after the last rains, the balsam trees are beaten on four sides of their stems with the back of an ax, a hammer, or other blunt instrument until the bark is loosened, four intermediate strips being left untouched that the tree may not be injured for the next year. Five or six days after men with resinous torches or bundles of lighted wood apply heat to the beaten bark, which becomes charred. It is left eight days, during which the burnt pieces of bark either fall or are taken off. As soon as they perceive that the bare places are moist with the exuding balsam, which takes place in a few days, pieces of rag (of any kind or color) are placed so as entirely to cover the bare wood. As these become saturated with the balsam, which is of a light-yellowish color, they are collected and thrown into an earthenware boiler, three-quarters filled with water, and stirred and boiled gently until the rags appear nearly clean, and the now dark and heavy balsam sinks to the bottom. Fresh rags belonging to the same owner are continually being put into the boiler until sun-down, when the fire is extinguished; when cold the water in the boiler is poured off, and the impure balsam set aside. During this process the rags that appear to have been cleared of balsam are taken out of the boiler at different times and given to a man to be pressed, by which means much balsam is still obtained. The press consists of a small open bag about 14 inches long, made of stout rope fixed together with twine, open at the middle and looped at both ends to receive two sticks. The rags are placed inside, and the whole is twisted round by means of the sticks and the balsam thus squeezed out. A washerwoman wringing out a wet cloth fairly represents the process. The balsam thus procured is added to that in the boiler. The next day the cold balsam is weighed and put into *tecomates* or gourds of different sizes and sent to market" (extract from *Reprint, with additions from Pharm. Jour. and Trans., Dec.*, 1863, *article on Peru Balsam*, by Daniel Hanbury).

Balsam of Peru is so-called because it originally went to Europe from Peruvian ports, and was thought to be a product of the Peruvian tree above mentioned. It now enters commerce from Acajutla either in earthenware jars or in metal drums. The balsam of our markets is not constant in quality or appearance.

Description.—Balsam of Peru is "a liquid having a syrupy consistence, free from stringiness or stickiness, of a brownish-black color in bulk, reddish-brown and transparent in thin layers, of an agreeable vanilla-like, somewhat smoky odor, and a bitter taste, leaving a persistent after-taste. On exposure to air it does not become hard. Specific gravity: 1.135 to 1.150 at 15° C. (59° F.). Miscible, in all proportions, with absolute alcohol, chloroform, or glacial acetic acid; only partially soluble in ether or benzin. It is completely soluble in 5 parts of alcohol. Water agitated with a portion of the balsam reddens blue litmus paper"—(*U. S. P.*). It is inflammable, burning with a fuliginous flame, and giving out an aromatic odor. It is miscible with water by means of mucilage.

Tests.—"If 1 Cc. of carbon disulphide be mixed with 3 Cc. of the balsam, contained in a dry test-tube, a clear liquid will result. On now adding 8 more Cc. of carbon disulphide and agitating the resinous constituent of the balsam (amounting to about 15 per cent) will adhere to the walls of the tube, and the liquid portion will be clear, of a tint not deeper than light-brownish, and not more than faintly fluorescent (absence of gurjun balsam). If 2 Cc. of the balsam be vigorously shaken in a dry test-tube with 8 Cc. of benzin, so that the balsam may be spread over the walls of the tube, and the liquid then immediately poured off, the balsam should remain adherent to the walls for some minutes and subside slowly, while the liquid (which should be filtered if turbid) should be colorless or only faintly yellow, and should deposit no sediment on standing (absence of appreciable quantities of storax, turpentine, copaiba, etc.). If 10 drops of the balsam be triturated in a small mortar with 20 drops of sulphuric acid, a tough, homogeneous, brownish-red mass will result, which, when washed with cold water, should, after a few minutes, be converted into a brittle, resinous mass (absence of fixed oils). On distilling water with a portion of the balsam no essential oil should pass over"—(*U. S. P.*). G. L. Ulex (*Jour. Pharm. and Trans.*, Vol. XII, p. 549, from *Archiv. der Pharmacie*, Jan., 1853) gives the following mode of detecting the purity of balsam of Peru: "To detect copaiba balsam, the substance is to be heated in a small tube retort until a few drops of a yellow, oily liquid have passed over, which takes place at a temperature of 190° C. (374° F.). This distillate is acid and soon deposits crystals of cinnamic acid. If the balsam was pure it solidifies completely, but when adulterated with copaiba the crystals float in copaiba oil. The distillate is then to be saturated with caustic potash, and the solution of cinnamate removed by means of blotting paper. The drops of oil which are then left mix quietly with iodine if the balsam was pure, but cause an immediate explosion if copaiba was present in it." Mr. W. J. Jenks gives the following simple method for detecting the *true* balsam of Peru from the false or adulterated: Place a drop or two of the article on the tongue, if it be true balsam it produces a liquid, diffused impression; if the false (a solution of resin), the resin is deposited on the tongue and on the back of the teeth" (*Amer. Jour. Pharm.*, 1867, p. 7).

Chemical Composition.—The chief constituent of this balsam appears to be *cinnamein* (*benzylic cinnamate*) ($C_9H_7[C_7H_7]O_2$). This, when treated with concentrated caustic alkalies, is resolved into *benzylic alcohol* (C_7H_8O) and *cinnamic acid.* The melting point of artificially-prepared cinnamein (Grimaux) is 39° C. (102.2° F.). Upon boiling it suffers decomposition.

According to the analyses of Kraut (1869) and Kachler (1870) the balsam contains, besides cinnamein, benzylic benzoate, benzoic and cinnamic acids, resin, and a small portion of benzylic alcohol, besides *stilbene*, found by Kraut alone. The resin (about 32 to 38 per cent) obtained as a residue by treatment with carbon disulphide is a "black, brittle, amorphous mass, having no longer the specific odor of the balsam" (*Pharmacographia*). By fusion with caustic potash Kachler (1869) obtained from it proto-catechuic acid; by destructive distillation toluol, styrol, and benzoic acid. *Benzylic benzoate* ($C_7H_5[C_7H_7]O_2$) is an oily, colorless substance, which boils near 340° C. (644° F.) and forms crystals at a much reduced temperature. *Benzylic alcohol* (*benzalcohol*) (C_7H_8O) is probably the so-called *peruvin* of Frémy in a purified condition. It is a colorless oil, feebly aromatic, boils at 204° C. (399.2° F.), and is not so light as water. It may be resolved into bitter almond oil, and subsequently into benzoic acid, by means of oxidizers. *Stilbene* is in the form of scales of a pearly luster, or in prismatic crystals, fusible, and boiling near 340° C. (674° F.). Its composition is $C_{14}H_{12}$. *Cinnamein* (*benzylic cinnamate*) is a brownish, aromatic fluid before purification and colorless when pure. It constitutes about 60 per cent of Peru balsam (Kachler). It is oily, feebly and agreeably odorous, and to the taste sharp and aromatic. The difficulty of distilling it, even with superheated steam of 300° C. (572° F.) or above, renders its extraction by this method less easy than by evaporation from carbon disulphide (Flückiger). Its density is near 1.095. It is the body called by Stolze *Peru balsam oil.* The leaves of *Myroxylon Pareiræ* yield a fragrant oil (*Pharmacographia*). *Vanillin* was isolated from Peru balsam by E. Schmidt, in 1885. Delafontaine, in 1870, found *cinnamyl cinnamate* (*styracin*) ($C_8H_7.COO\,[C_9H_9]$).

Action, Medical Uses, and Dosage.—This agent in medicinal doses occasions some cutaneous heat, increases the rapidity of the circulation, and augments the renal secretion, with irritation of the kidneys. Large doses, by producing gastro-intestinal irritation, may cause diarrhœa and vomiting. It should not be employed in febrile states. Balsam of Peru possesses expectorant and stimulating properties, acting more especially on mucous tissues, lessening their secretions when profuse. It is useful in all chronic affections of mucous tissues, as in *catarrh, gonorrhœa, mucous inflammation of the stomach and bowels, chronic diarrhœa* and *dysentery, leucorrhœa*, etc. Externally it forms an excellent application to *obstinate ulcers, wounds, ringworm of the scalp, eczema*, and other *cutaneous affections.* It may be applied alone, or in ointment made by melting it with an equal part, by weight, of tallow. It is much employed in Germany to destroy the *itch insect* and its eggs. After a warm bath the whole body is rubbed three times a day with 40 drops of the balsam. This is done for two days when the scabies is cured. It is considered antiseptic, and has recently been applied locally to *tuberculous ulcers*, involving the bones, larynx, and skin. *Wounds* are readily healed by it in parts lacking vitality. *Chilblains, sore nipples, pruritus vulvæ*, and *senile pruritus* are said to be promptly relieved by it. The dose is from 10 to 30 drops, and is best given diffused in water by means of sugar and the yolk of egg, or gum Arabic, or in alcoholic solution dispensed in glycerin. Used in ointment with beef's marrow, 1 ounce, sulphate of quinine 10 grains, balsam Peru 1 drachm, it forms an excellent tonic and stimulant preparation for *alopecia.*

Related Species.—*Myroxylon Peruiferum*, Linné filius (*Myroxylon pedicellatum*, Klotzsch; *Toluifera Peruifera*, Baillon). This is the tree that was formerly supposed to yield balsam of Peru. It is a large tree, with a thick, straight, smooth trunk; a coarse, gray, compact, heavy, granulated bark, of a pale, straw color, filled with resin, which, according to its quantity, changes the color to citron, yellow, red, or dark-chestnut; smell and taste grateful, balsamic, aromatic; leaves pinnated; leaflets alternate, of 2, 3, 4, or even 5 pairs, ovate-lanceolate, acute, coriaceous, somewhat emarginate at the apex, shining above, hairy on the underside, marked with transparent spots, terminal one the same size as the others; flowers in axillary racemes longer than the leaves; calyx campanulate, nearly equally 5-toothed, with the odd tooth remote from the others; petals 5, white; upper reflexed, broad, roundish, emarginate; the other four distinct, linear-lanceolate, reflexed, spreading; stamens 10, distinct, spreading, shorter than the petals; anthers mucronate; samaras pendulous, straw-colored, pedicellate, linear-oblong, about 2 inches in length, compressed, membranous, except at the apex, which is obliquely rounded, clavate, 1-celled, 1-seeded; seed reniform, lying in yellow liquid balsam, which hardens into resin (L).

The *Myroxylon Peruiferum* is common to the forests of Peru in low, warm, sunny situations near the river Maranon, and in other portions of South America, as New Granada, Brazil, Ecuador, and Bolivia, flowering from July to October. The resin, obtained in small quantities, resembles Peru balsam, except that it is harder and of a deeper-red tint. No crystals could be detected in it when pressed between two warm glass-plates (*Pharmacographia*). Its density is 1.031. It has an astringent, feebly-pungent, balsamic taste. With sulphuric acid it yields a sticky, grease-like mass, and not a brittle resinous body like Peru balsam. Both castor oil and alcohol dissolve it in any quantity, forming solutions which are clear.

BALSAMO BLANCO ("*Balsamito*" or "*Balsamo catolico* or *Virgin balsam*") (*Pharmacographia*).—There is likewise a variety of Peruvian balsam of a pale-yellowish color, syrupy, becoming crystalline, highly fragrant (odor of melilot), and of a bitterish, acrid, somewhat aromatic taste. It is called *White Peruvian balsam*, and is obtained by expressing the fruit. It is of very fine quality, but is not prepared for market. Prismatic crystals of *myroxocarpin* ($C_{24}H_{34}O_3$), a neutral resin, were obtained from it by Stenhouse, in 1850. Dorat (letter to Hanbury) states that "from the flowers there is distilled a most delicious and fragrant *aguardiente*, far superior to any brandy." When dried this balsam constitutes the *Dry Peruvian balsam* or *Indian opobalsamum*, and is of a reddish, pulverizable, resinoid character. The fruit infused in rum is used for several medicinal purposes by the natives, also under the name of *balsamito.*

RESINOUS EXUDATE.—The *Myroxylon Pareiræ* exudes a natural resin, which, according to Dorat and others, is not aromatic, and which Attfield declares to be devoid of *cinnamic acid.* The latter found it to contain resin, uncrystallizable and feebly acid, 77.4; gum, similar to gum acacia, 17.1; limpid, fragrant, colorless, volatile oil and water, about 4.0; woody fiber, 1.5. It has no relation to the balsam, though obtained from the same tree.

BALSAMUM TOLUTANUM (U. S. P.)—BALSAM OF TOLU.

"A balsam obtained from *Toluifera Balsamum*, Linné" (*U. S. P.*) (*Myroxylon Toluifera*, Kunth; *Myrospermum Toluiferum*, Richard; *Toluifera Balsamum*, Miller).

Nat. Ord.—Leguminosæ.

Common Names: (Balsam) *Balsam of Tolu*, *Tolu balsam;* (tree) *Tolu balsam tree.*

Illustrations: Köhler, *Med. Pflanzen;* Bentley and Trimen, *Med. Plants*, p. 84.

Botanical Source.—This tree very closely resembles that yielding balsam of Peru. The trunk is tall and bare, and at about 40 to 60 feet from the ground throws out its branches, producing a rounded crown of foliage. The younger the tree the larger the foliage of obovate leaflets, older trees suffering from the drainage of balsam. The flowers are borne in dense, axillary racemes, 3 to 4½ inches long, and the calyx tube is rather tubular. The fruit is an oblong, linear legume, scarcely narrowed at its base. The tree, which is an evergreen, rises to a height of 70 or 80 feet.

History.—As with the preceding article, so with the present, it has been involved in considerable obscurity, it formerly being uncertain whether the same trees which yield balsam of Peru furnished likewise that of Tolu. Some, notably Baillon, consider that the two balsams are derived from the same species, and that the method of gathering, etc., causes their dissimilarity. It is, we believe, now quite definitely settled that entirely distinct species furnish the two balsams. The Toluifera Balsamum, which is undoubtedly the one species from which tolu is obtained, is found in many parts of South America, especially on the elevated plains and mountains near Carthagena, Tolu, and in the Magdalena province of Columbia. The balsam is said to be obtained by incisions made into the tree, from which it flows into wax (formerly) vessels placed for the purpose, and in which it solidifies. For the mode of procuring balsam of Tolu, see a paper by Mr. John Weir (*Lond. Pharm. Jour.*, 1864, and *Amer. Jour. Pharm.*, 1864, p. 449), summarized as follows by the authors of the *Pharmacographia:* "The balsam tree has an average height of 70 feet, with a straight trunk, generally rising to a height of 40 feet before it branches. The balsam is collected by cutting in the bark two deep, sloping notches, meeting at their lower ends in a sharp angle. Below this V-shaped cut the bark and wood is a little hollowed out, and a calabash of the size and shape of a deep tea-cup is fixed. This arrangement is repeated, so that as many as 20 calabashes may be seen on various parts of the same trunk. When the lower part has been too much wounded to give space for any fresh incisions, a rude scaffold is sometimes erected, and a new series of notches made higher up. The balsam-gatherer goes from time to time round the trees with a pair of bags of hide, slung over the back of a donkey, and empties into them the contents of the calabashes. In these bags the balsam is sent down to the ports, where it is transferred to the cylindrical tins in which it reaches Europe. The bleeding of the trees goes on for at least 8 months of the year, causing them ultimately to become much exhausted and thin in foliage" (*Pharmacographia*, 2d ed., p. 203).

Description and Tests.—Balsam of Tolu is imported from Carthagena in tin, earthen, and other vessels. When first received in this country it is soft and adhesive. As described by the *U. S. P.*, it is "a yellowish-brown, semifluid or nearly solid mass, becoming more brittle when exposed to cold, transparent in thin layers, having an agreeable odor recalling that of vanilla, but distinct from it, and a mild, aromatic taste. Readily and completely soluble in alcohol, the solution showing an acid reaction with litmus paper. Also completely soluble in chloroform and in solutions of the fixed alkalies; almost completely soluble in ether, but nearly insoluble in water, benzin, or carbon disulphide"—(*U. S. P.*). It softens when chewed, melts when heated, and when burned evolves a fragrant odor.

Chemical Composition.—According to Frémy, Tolu balsam consists of cinnamein, cinnamic acid, and resin, and the balsam resinifies to a crystalline mass with greater facility than the balsam of Peru. About 8 parts of volatile oil are obtained from 4000 parts of tolu by distillation with water; this oil contains *tolene* ($C_{10}H_{16}$), which is thin, colorless, and volatile, and has an acrid, hot taste and a pleasant odor. Its density is 0.858. Oxygen is rapidly absorbed by this body. Benzoic acid, cinnamic acid, benzylic benzoate, and benzylic cinnamate are present in balsam of Tolu, the latter in larger proportion (Busse). *Vanillin* was also found in this balsam (E. Schmidt). Guibourt states that as the balsam solidifies its odor becomes more feeble, but its quantity of cinnamic acid is augmented, which is probably owing to the action of the atmosphere upon its oil effecting a chemical change. According to E. Kopp, the solid, resinous portion of the balsam consists of two resins which have the composition of hydroxides of styracin (see *Balsam of Peru*), one easily and the other difficultly soluble in alcohol. Deville, however, maintained that there is but one resinous body. Upon dry distillation, beside the above-mentioned acids and ethers, balsam of Tolu yields a hydrocarbon termed toluol (C_7H_8), styrol, and phenol. *Toluol*, or *toluene* (C_7H_8), is the body found among the products when wood, certain resins, and other vegetable substances are submitted to destructive distillation. It is likewise found in coal tar. Chemically it is *methyl-benzene* ($C_6H_5.CH_3$ or C_7H_8). It is a powerfully refractive, oily liquid devoid of color, and has a benzol-like odor. It boils at 111° C. (231.8° F), and refuses to congeal at —20° C. (—40° F.). Its density is 0.86.

Balsam of Tolu is scarcely soluble in the essential oils (*Pharmacographia*), but water at 100° C. (212° F.) takes up its *cinnamic acid*. It yields very little volatile oil when distilled with water, and if the distillation be continued its acid sublimes. Mr. Hatchett found that when he dissolved it in the smallest possible quantity of liquor potassæ, it completely lost its own odor and assumed a most fragrant smell, somewhat resembling that of the clove-pink (T.). "When balsam of Tolu is pressed between two warm plates of glass, so as to obtain it in a thin, even layer, and then examined with a lens, it exhibits an abundance of crystals of cinnamic acid" (*Pharmacographia*). Acetone and glacial acetic acid easily dissolve it, and it is insoluble in benzene. G. L. Ulex (*Pharm. Jour. and Trans.*, p. 550, Vol. XII, from *Archiv. der Pharmacie*, Jan., 1853) gives the following mode of testing the purity of balsam of Tolu: "Pure Tolu balsam, heated in sulphuric acid, dissolves without any disengagement of sulphurous acid, yielding a cherry-red liquid; when, however, colophony, with which it is frequently adulterated, is present, the substance blackens, swells up, and disengages much sulphurous acid." The same is true of turpentine. "Carbon disulphide, aided by a gentle heat, removes from the balsam scarcely anything but some of its cinnamic and benzoic acids. On decanting and evaporating the disulphide no substance having the properties of *resin* should remain"—(*U. S. P.*). Recently efforts have been made to distinguish between the different balsams, including Tolu and Peru balsams, and to recognize admixtures of resin, etc., by determining the saturation-power of the balsams for alkalies, and by similar methods (Kremel and Dieterich).

Action, Medical Uses, and Dosage.—Balsam of Tolu, like that of Peru, is a stimulant, tonic, and expectorant, and may be used as a substitute for it in *chronic catarrhs*, and other *pulmonary affections* not actively inflammatory in their character. It is usually preferred on account of its more agreeable flavor, and for which it is often added to cough-mixtures. The balsam, dissolved in ether, and the vapor therefrom inhaled, is reputed beneficial in *coughs* and *bronchial affections* of long standing. Two parts of Tolu, 3 of almond oil, 4 of gum Arabic, and 16 of rose water, make an excellent liniment for *excoriated nipples*. The dose is from 10 to 30 grains, frequently repeated, and given in tincture, syrup, or similar to balsam of Peru.

Related Species.—*Myroxylon punctatum*, Klotzsch (*Toluifera punctata*, Baillon; *Myrospermum balsamiferum*, Ruiz et Pavon). This species grows in the northern portion of South America, and is known to the Peruvians as *Quino-quino*. Bentley, Trimen, and Flückiger, among others, regard it as identical with *Toluifera Balsamum*, Miller.

Bowdichia major.—Yields the hard, yellow, bitter bark, *Sucupira*; contains an alkaloid possessing mydriatic power (Petit). The Brazilians employ the bark in *rheumatism* and *fevers*.

BAPTISIA.—WILD INDIGO.

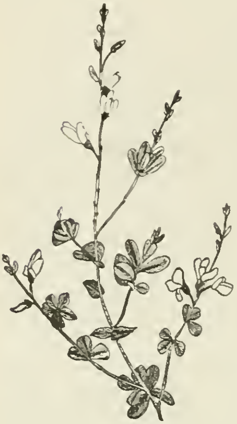
The root and leaves of *Baptisia tinctoria*, Robert Brown (*Sophora tinctoria*, Linné; *Podalyria tinctoria*, Michaux).

Nat. Ord.—Leguminosæ.

Common Names: *Wild indigo*, *Indigo weed*.

Botanical Source.—Wild indigo is a perennial plant having a stem from 2 to 3 feet high, glabrous and branching, yellowish-green in color, and studded with small black dots. The leaves are subsessile, 3-foliate-palmate; the leaflets small, roundish, or obovate, acute at base, very obtuse at apex, bluish-green in color, and turn black on drying. The stipules are setaceous and caducous. The flowers are bright yellow, few, and borne in small, loose, terminal racemes. The calyx is 4 or 5-toothed. Petals 5, stamens 10, and distinct. The fruit is a subglobose, bluish-black pod the size of a pea, on a stalk longer than the calyx, and contains several seeds.

Fig. 38.



Baptisia tinctoria.

History.—Wild indigo is an indigenous perennial, having the appearance of a shrub, growing all over the United States in woods and on hillsides. It thrives best on dry, poor soils, being seldom met with in alluviums and rich, loamy soils. In New England the young shoots, like asparagus and poke, are eaten for greens, and like the latter, if too far advanced in growth, act as a drastic cathartic. The plant blooms from June to September, and yields a blue dye, not unlike, but inferior, to indigo. Baptisia is familiarly known as wild indigo, indigo weed, horsefly weed, yellow broom, clover broom, rattle bush, and yellow indigo. The name baptisia is derived from the Greek *bapto* or *baptizo* (to dye, to color), the plant having formerly been used as a coloring agent.

Owing to the great number of antiseptic remedies that have been presented to the profession within the last few years, wild indigo, the favorite drug of this class with the early Eclectics, has fallen into unmerited neglect. Baptisia was mentioned early in the present century by Dr. James Thacher, in his *Dispensatory*, as a local remedy for gangrenous and other ill-conditioned sores due to debilitated conditions of the body. Still it received but little attention until the "Eclectic fathers," in their studies of indigenous plants, pronounced it a valuable drug. In the *Western Medical Reformer* for 1846, Prof. John King highly recommended it for its alterative and antiseptic properties. Prior to this (1837) it was used by Eclectic physicians in diarrhœa with offensive discharges and typhus (?) fever, scarlatina maligna and putrid sore throat.

Description.—Baptisia presents a root-head, giving off knotted branches, and numerous bent or curved roots about 18 to 20 inches in length and from ⅛ to ½ inch in thickness. Externally the bark is rather scaly or dotted with wart-like excrescences, and is brown in color. The root breaks with a tough, fibrous fracture, displaying a whitish interior. The bark is thick; the corky layer thick and brown; the woody portion strong and porous. The root is inodorous, and of a nauseous, somewhat acrid taste; its virtues appear to reside chiefly in the bark. Both the root and leaves are medicinal. When the whole plant or any portion of it is dried it becomes black, and yields a blue dye, inferior to indigo. Alcohol or water will take up its active properties; also chloroform, ether, and glycerin.

Chemical Composition.—Mr. B. L. Smedley found in the root gum, albumen, starch, a yellowish resin, and a crystalline substance, which he believed to be probably a new alkaloid (*Amer. Jour. Pharm.*, 1862, p. 310). This supposed alkaloid was, however, asserted by Mr. J. A. Weaver to be a calcium salt. Both Weaver (1871) and Dr. F. V. Greene (1879) found an alkaloid the chloride of which possessed a nauseous, acrid taste. This alkaloid, *baptisine* (*baptitoxine*), will not dissolve in chloroform, benzol, or benzin, but it is soluble in water, ether, and alcohol. It has an acrid taste, and is said to be actively poisonous. Later investigations by Von Schroeder (1885) show the existence of three active constituents in baptisia root. One of them is the above *baptisine*, to which he gives the name *baptitoxine*. The others are two glucosids, *baptisin* and *baptin*. The former is bitter, does not dissolve in water, and is indifferent, so far as its activity is concerned.

The other (*baptin*) is in the form of soluble, acicular crystals, and is laxative and cathartic. The glucosid *baptisin* should not be confounded with the "Eclectic concentration," BAPTISIN, described below. The active principles of baptisia root were recently investigated, in detail, by Dr. K. Gorter (*Arch. der Pharm.*, 1897). He isolated *baptisin*, a non-bitter and (to frogs) non-poisonous glucosid of the formula, $C_{26}H_{32}O_{14}+9H_2O$, capable of splitting with diluted sulphuric acid into sugar and *baptigenin* ($C_{14}H_{12}O_6$). Baptisin melts at 240° C. (464° F.); is difficultly soluble in water and dilute alcohol; when cold easily soluble in glacial acetic acid. He furthermore isolated the alkaloid *baptitoxine*, which he found identical with *cytisine* ($C_{11}H_{14}N_2O$), the alkaloid of the unripe seeds of Laburnum (*Cytisus Laburnum*). Previously (1895) Plugge established the identity of Von Schroeder's baptitoxine, which he obtained from the *seeds* of baptisia with *cytisine*, hence *ulexine*, *sophorine*, *baptitoxine*, and *cytisine* all denote one and the same substance.

Action, Medical Uses, and Dosage.—To the taste baptisia is somewhat bitter, subacrid, and subastringent. It increases the secretions of the glandular apparatus of the gastro-intestinal tract. Large doses are dangerous, acting as an emetocathartic. Sometimes this action is so violent as to produce gastro-enteritis. Large doses have caused an excessive flow of viscid saliva, ulceration of the pharynx, insomnia, restlessness, and ocular disturbances. It produces soft, mushy stools, accompanied by a sensation of soreness of the whole body. Small doses act as a laxative. Baptisia is an active and efficient hepatic, stimulating the liver and causing an increased biliary secretion. It loses much of its activity when dried or boiled. It is asserted that *baptitoxine* increases the respiratory movements, and in toxic doses kills by asphyxiation through paralysis of the respiratory centers.

Therapeutically baptisia is indicated in pathological conditions characterized by feeble vitality with tendency to disintegration of tissue. The keynote of this drug is *sepsis*, accompanied by dark or purplish discoloration of skin and mucous membranes. The appearance of the face is swollen, dusky, and expressionless—has the appearance of having been long exposed to cold. It is not the remedy for acute disease characterized by great activity, but rather for cases showing marked capillary feebleness, with tendency to ulceration—a condition of atony.

Baptisia was first employed as a dressing for all kinds of *ulcerations*, *malignant ulcers*, *sore mouth*, mercurial or otherwise, especially when accompanied by foul breath, loss of appetite, and general gastric disturbance. *Sore nipples*, *erysipelatous*, *scrofulous*, and *syphilitic ulcers* were treated with a decoction of wild indigo. The greater the tendency to mortification, the more highly the remedy was valued. It controls irritable and painful *ulcers*, lessens their foul discharges, and overcomes putrescency.

Baptisia is of marked value in many forms of *malignant sore throat*. The dusky, leaden-colored, faucial ulcerations of *scarlatina* and *tonsillitis* point to this drug. *Diphtheria*, with swollen and enfeebled mucous membranes, with free secretion, appearing either dusky or blanched, and accompanied by sloughing, calls for baptisia. While the infusion is undoubtedly the best preparation of baptisia, it can not always be employed, for the dried plant is almost worthless, and the fresh herb not always easily procured. We depend upon specific baptisia, giving it internally in small doses, and applying it locally, diluted with water. *Putrid ulcerations* of the mucous membranes of the nasal passages are benefited by baptisia. The offensive breath, with turgidity of tissue, will indicate the drug.

All *typhoid conditions*, marked by the dusky appearance of skin and mucous tissues, are promptly benefited by this agent. *Typhoid dysentery*, with stools like "prune juice or meat washings," or dark, tar-like, fetid discharges, mixed with decomposed blood, yields to its kindly action. *Typhoid fever* with persistent diarrhœa, *typhoid pneumonia*, *typho-malarial fever*, as well as common *continued fever*, with the usual indications, call for baptisia. It is said to be valuable in *variola* and *cerebro-spinal meningitis*. In the *sore throat of variola* it is of great utility. *Septicæmia* following retained fragments of placenta after abortion has been promptly checked by this drug. In *fetid leucorrhœa* and *ulceration of cervix uteri*, especially with muco-purulent discharges, a douche of baptisia will be found beneficial. It acts as a gentle excitant and local tonic to the vessels implicated in the ulcerative process. It has been employed with good results in atonic varieties of *acute rheumatism.* In *fetid discharges from the ears*, etc., the infusion will be found efficient, if injected into the parts with a suitable syringe. The leaves applied in fomentations have discussed *tumors* and *swelling of the female breast*, resembling scirrhus. Webster suggests baptisia in *mania*, *dementia*, and *melancholia*, with stupor, in conditions characterized by drowsiness in typhoid states. Baptisia is an old and tried remedy, but will still repay further study.

Dose of the decoction—made by boiling 1 ounce of the powdered bark in 2 pints of water down to 1 pint—1 tablespoonful every 1, 2, or 4 hours, as required; if it purge, produce nausea, or a disagreeable relaxation of the nervous system lessen the dose, or omit its use entirely for a time; of the alcoholic extract, 1 to 4 grains every 2, 3, or 4 hours. The usual form of administration is as follows: ℞ Specific baptisia, gtt. xx; aqua, fl℥iv. Mix. Sig.: Teaspoonful every ½ or 1 hour. Indicated remedies may be given with or alternated with the above. Locally an infusion of the recent plant; or, ℞ Specific baptisia, fl℥ss; aqua, Oi. Mix. Sig.: Apply 2 or 3 times daily. *An ointment:* ℞ Specific baptisia, fl℥i; vaseline, ℥i. Mix. Sig.: Apply locally to inflamed *tumors*, *chancres*, *buboes*, and *ulcers*.

Specific Indications and Uses.—The indications will be found to be *fulness of tissue*, with dusky, leaden, purplish, or livid discoloration; tendency to ulceration and decay; sepsis; typhoid conditions; enfeebled capillary circulation; color of skin effaced by pressure and returns slowly; patient's face swollen and bluish, appearing like one having been frozen, or long exposed to cold, fetid discharges, with atony, and gangrene.

Related Species.—*Baptisia alba*, Robert Brown. *Prairie indigo.* Plains of western United States and in rich soil from Virginia to Florida. This species has white flowers, and is said to possess similar properties to the *Baptisia tinctoria*, for which it has been used as a substitute.

Castella Nicholsonii.—Contains a resinous body named by Putegnat *amargosin.* Reputed antiseptic.

Derivative.—BAPTISIN, prepared similarly to aletrin, was once supposed to be the active principle of the plant, but it is a mixture containing a greater or less proportion of the active principles of baptisia. *Baptisin* is of a yellowish-brown color, a strong odor, similar to that of the powdered root, and of a rather bitter, not very disagreeable taste, persistent in its character. It is partially soluble in alcohol, but gives a precipitate on standing. "I have found it to exert a powerful influence on the glandular system in doses of from ¼ to ½ grain; if given in large doses it produces a very disagreeable prostration of the whole system. It is also an excellent application to *gangrenous* and *erysipelatous ulcerations*, and *malignant* and *fetid ulcerations of the cervix uteri.* Combined with extract of leptandra, resin of podophyllum, quinine, or resin of cimicifuga, in diseases where these agents are indicated, it will be found valuable in *typhus* and *typhoid fevers*, *dysentery*, and all diseases of a typhoid character, when administered internally" (Prof. King, in *Amer. Disp.*, 15th ed.).

BARII DIOXIDUM (U. S. P.)—BARIUM DIOXIDE.

FORMULA: BaO_2. MOLECULAR WEIGHT: 168.82.

SYNONYM: *Barium peroxide.*

"Commercial, anhydrous barium dioxide. It should be kept in well-closed vessels"—(*U. S. P.*).

Preparation.—This preparation is formed when baryta (barium monoxide, BaO) is heated to redness in a current of dry oxygen. It usually contains silica, lime, and iron oxide, which substances consequently exist as impurities in peroxide of hydrogen prepared from commercial barium dioxide. Therefore, aside from other considerations, it is better to use hydrated dioxide of barium to prepare this compound (see below).

Description.—"A heavy, grayish-white, or pale yellowish-white, amorphous, coarse powder, odorless and tasteless. When exposed to the air it slowly attracts moisture and carbon dioxide, and is gradually decomposed. Almost insoluble in cold water, with which, however, it forms a definite hydrate, and to which it imparts a decidedly alkaline reaction. Hydrochloric, phosphoric, and most other mineral acids, decompose it, producing the corresponding barium salts and hydrogen dioxide, which remains in solution for a considerable time, if the reaction has taken place in the cold, and an excess of the acid is present. When heated to a bright-red heat barium dioxide fuses, loses oxygen, and is reduced to barium oxide. Barium dioxide should be dissolved by diluted hydrochloric or phosphoric acid without leaving more than a trace of residue"—(*U. S. P.*).

Tests.—"If 2.11 Gm. of barium dioxide be dissolved as completely as possible in ice-cold water to the volume of 25 Cc., with the aid of 7.5 Cc. of phosphoric acid, and 5 Cc. of this solution (corresponding to 0.422 Gm. of the dioxide) be measured off for assay, it should require not less than 40 Cc. of decinormal potassium permanganate V.S. to impart to the liquid a permanent pink tint, corresponding to not less than 80 per cent of pure barium dioxide (each cubic centimeter of the volumetric solution indicating 2 per cent of the latter"—(*U. S. P.*).

Uses.—This salt is used for preparing the official solution of dioxide (peroxide) of hydrogen.

Barium and Its Compounds.—Barium. Symbol: Ba. Atomic Weight: 136.8. Barium is the metallic basis of the alkaline earth *baryta* (barium monoxide, BaO). It occurs, in nature, in the form of *heavy spar* (barium sulphate, $BaSO_4$) and as *witherite* (barium carbonate, $BaCO_3$), from which minerals it is chiefly obtained. It was isolated by Sir Humphrey Davy in 1808. It is also contained, to some extent, in certain mineral waters and in sea-water, feldspathic rocks, some silicates, and several manganese ores. It is a solid metal of a lustrous, silvery color, melts at a temperature below redness, and is not volatilized by a heat capable of melting plate glass, but at that temperature it acts violently upon the glass, probably decomposing its alkali. Exposed to the air it rapidly tarnishes, absorbs oxygen, and is converted into baryta or barytes. It sinks rapidly in water, decomposes it with great rapidity, hydrogen being evolved, and is converted into baryta. When strongly pressed it becomes flat and appears to be both ductile and malleable. All of the soluble barium salts are powerfully poisonous. They are antidoted by sulphate of sodium (Glauber's salt), sulphate of magnesium (Epsom salts), and sulphate of aluminum.

Hydrated Dioxide of Barium (BaO_2+8H_2O) is made as follows: Add powdered barium dioxide gradually to diluted hydrochloric acid until the acid is nearly neutralized; cool, filter, and add cautiously baryta-water until the silica and metallic oxides cease to separate and the white hydrated barium dioxide appears; then filter and add concentrated baryta-water until a precipitate ceases to form. Collect the precipitate upon a filtering-paper, wash with cold water, and preserve in well-corked bottles. It is used for the preparation of hydrogen dioxide, but otherwise is not employed in medicine.

Barii Hydroxidum.—*Barium hydroxide* ($Ba[OH]_2$). Molecular Weight: 170.82. *Barium hydrate*, also called *heavy earth*, "*terra ponderosa*," is hydroxide of barium, and is formed when barium has been put into water. It was discovered, in 1774, by Scheele. It may be procured from the native sulphate of barium or ponderous spar, by mixing this in very fine powder with one-eighth its weight of powdered charcoal, keeping it at a red-heat for some time in a crucible: dissolving the sulphide of barium thus formed in nitric acid, filtering the solution, which is a nitrate of barium, sulphur being deposited, and slowly evaporating the filtered liquid till it crystallizes. Place the crystals of nitrate of barium in a crucible, and drive off the nitric acid by a strong heat gradually applied, whereby caustic baryta (BaO) is formed. Caustic baryta is a grayish-white, porous body, having an acrid, alkaline taste, no smell, an alkaline reaction, and when taken into the stomach proves a most violent poison. Its specific gravity is 4.5. In the air it attracts moisture, swells with heat, and falls to a white powder. It slakes with water like quicklime, forming the above hydrate; and water dissolves .05 part its weight of barium hydroxide, forming the test reagent for sulphuric and carbonic acids, known by the name of *baryta-water*. It forms several salts used in medicine and pharmacy. It should not effervesce upon the addition of acids.

Barii Carbonas ($BaCO_3$). Molecular Weight: 196.85. *Carbonate of barium, Baryta carbonica*. Also called *witherite* after Withering, who first found it native in 1783, though previously examined by Bergmann. It is found in Hungary, Sicily, Siberia, Neuberg in Styria, etc., but occurs in considerable quantity in veins along with lead ore in different parts of England, and is found also in Scotland and in the Scandinavian Peninsula. It may be prepared artificially by exposing baryta-water to the air, or by passing carbonic acid gas into it; in either case the carbonate precipitates in the state of a white powder. The native carbonate occurs in masses, stalactitic, and crystallized in six-sided prisms formed by the intersection of three primary, right-rhombic prisms. It is poisonous, has no sensible taste, and when native has the specific gravity, 4.331; when artificial it scarcely exceeds from 4.23 to 4.30. Cold water dissolves $\frac{1}{4304}$ part, and boiling water $\frac{1}{2304}$ part of this salt; it is unalterable in the air, and when exposed to a blow-pipe heat it fuses, evolving much light, losing carbonic acid gas, and presenting the appearance of white enamel. It is dissolved or acted upon by the mineral acids with effervescence. Its principal use is in the preparation of barium chloride. It was formerly employed in *parasitic skin diseases*. Weakness of the legs, paralysis, and death have been produced by it. Webster declares it is a superior remedy for *acute parenchymatous tonsillitis*, to control the vascular disturbance and avert the formation of pus. Used early he claims it is abortive; less valuable in chronic cases. Homœopathic dilution (6 x), in 5 to 10-drop doses every 3 hours, in acute cases; 3 or 4 times a day, in chronic cases. *Specific Indications:* Scudder's indications are, "Weight and pressure about the pubes; scanty menstruation; very sensitive to cold; 2 x to 6 x trituration, ¼ to 1 grain."

Barii Chloridum ($BaCl_2+2H_2O$). Molecular Weight: 243.5. *Chloride of barium.* This salt is easily obtained by dissolving carbonate of barium in diluted hydrochloric acid, evaporating the solution, so that on cooling crystals may form. Or it may be prepared by mixing powdered sulphate of barium with one-fourth its weight of charcoal, heating the mixture in a covered crucible for three hours at a low, white heat, powdering the product, stirring it well with 15 parts of water, boiling, filtering, and adding to the filtered liquor hydrochloric acid in small portions at a time until effervescence ceases, and the solution is neutral to test paper; again filter, evaporate, and set aside for crystallization. In this latter process be careful not to inhale any of the hydrogen sulphide gas which escapes on the addition of the hydrochloric acid. Chloride of barium forms transparent, right-rhombic, tabular crystals, generally flattened at the corners, odorless, of an unpleasant, sharp, amarous taste, permanent in the air, soluble in 2½ parts of cold and 1½ of boiling water, insoluble in strong alcohol, and of specific gravity, 3.05. When heated they lose their water of crystallization, and at a red heat fuse to a clear liquid. If the salt attracts moisture from the air it contains chloride of calcium; this is proved by shaking the finely-powdered salt with absolute alcohol, which dissolves any chloride of calcium or strontium present, filtering, evaporating the filtrate, treating the residue with water, and then with diluted sulphuric acid; a precipitate denotes strontium; this is filtered off, and after saturating the filtrate with ammonia, oxalate of ammonium is added, and any turbidity caused by it is due to calcium salts. The solution of chloride of barium must be so thoroughly precipitated by sulphuric acid as to yield no residue on evaporation; should there be a permanent one on heating, it is due to impurities. A blue precipitate with ferrocyanide of potassium denotes iron; with ammonia a white precipitate, disappearing on the addition of sal ammoniac, denotes magnesia, the chloride of which, like that of calcium, deliquesces in the air, and may also be a cause of the moisture of the chloride of barium. A blue color caused by the ammonia arises from copper. Chloride of barium is incompatible with the alkaline and metallic sulphates, the phosphates and carbonates. In large doses this salt is a violent poison, affecting the nervous system chiefly. Vomiting and purging, with abdominal pain, collapse, with extremely weak and thready pulse, labored breathing, with effusion into the bronchiæ, muscular weakness, coma, and death, preceded by convulsions, are the toxic phenomena. In small doses it is said to be useful in *scrofula, dropsy, scirrhous affections, bronchocele*, etc. It is used in solution, both externally and internally, 1 part of the chloride being dissolved in 8 parts of distilled water, and administered in doses of 10 drops, 2 or 3 times a day, gradually and carefully increased until nausea or giddiness is experienced. It has been used as a lotion in *herpetic eruptions*, and as a collyrium in *scrofulous ophthalmia* but its external use must be conducted with caution, as it is easily absorbed. It has lately (1889) been proposed as a heart stimulant, to increasing force, rhythm, and volume of the circulation. The dose for this purpose is $\frac{1}{10}$ grain. When taken in poisonous doses its antidotes are the sulphates, as sulphate of magnesium, with a free use of well or spring water, and evacuating the stomach as soon as possible,. together with other treatment indicated by the symptoms present.

Chloride of barium, in solution, is employed as a test for sulphuric acid or the sulphates in solution, with which it forms a white precipitate of sulphate of barium (see *Test Solutions*), insoluble in mineral acids, except strong sulphuric acid.

Liquor Barii Chloridum of the *U. S. P.* (1870), was prepared by dissolving 1 troy ounce of barium chloride in 3 fluid ounces of distilled water (see *Test Solutions*).

Specific Indications and Uses.—Prof. Scudder (*Spec. Med.*) says of barium chloride: "In its action upon the economy this remedy has some resemblance to arsenic, and is indicated by an inelastic, dirty skin, enlarged lymphatics, and feeble respiration. It has been employed as a remedy in *cancer, scrofula*, and *scrofulous phthisis.* It has been deemed of especial value in *scrofulous inflammation of eyes, ears*, and *testes.*" A teaspoonful of the dilution of 10 drops of the *U. S. P.* (1870) solution in 4 fluid ounces of water may be given every 3 or 4 hours, or 2 or 3 grains of the 3 x trituration may be employed.

Barii Nitras ($Ba[NO_3]_2$). Molecular Weight: 260.58. *Nitrate of barium.*—This salt was known immediately after the discovery of baryta, and may be prepared by dissolving native carbonate of barium in nitric acid; or by decomposing sulphide of barium by means of nitric acid, filtering, evaporating, and crystallizing. It crystallizes in transparent, permanent octahedra and tetrahedra, is odorless, of a pungent and slightly bitter taste, soluble in 14 parts of water at 15.5° C. (60° F.), in 3 parts of boiling water, and slightly soluble in alcohol. Heat fuses it, with decrepitation; a strong heat drives off the nitric acid, and leaves pure barium monoxide. Firework makers use it to communicate a beautiful, green tinge to flame. It is employed in chemistry and pharmacy, in solution, as a test for sulphuric acid and sulphates, instead of the chloride of barium, when it is considered desirable to avoid the presence of a metallic chloride. The solution is made by dissolving one part of the nitrate in 20 parts of distilled water, and keeping the solution in well-closed bottles.

Barii Iodidum (BaI_2+2H_2O). Molecular Weight: 425.88. *Iodide of barium.*—This salt may be obtained by dissolving carbonate of barium in hydriodic acid or by Magendie's formula: Take iodine, 100 parts; iron filings, 30 parts; water a sufficient quantity; form an iodide of iron, to which add a solution of barium hydroxide, 1 part, in distilled water, 20 parts, and continue it as long as a precipitate occurs; heat for a few seconds, filter the solution, concentrate by evaporation, and crystallize. It crystallizes in fine, acicular prisms, which are very soluble in water, and but feebly deliquescent. When long exposed to the air, a portion of the hydriodic acid is decomposed and dissipated, carbonate of barium is formed, and hydriodate of barium, colored by iodine, may be dissolved by water. It is a violent poison, requiring great caution in its use. Jahn recommended it as a powerful alterative, resolvent, and liquefacient, in *scrofulous enlargements, hypertrophy*, etc. The dose is ⅛ of a grain, very cautiously increased to 1 grain, 3 times daily, dissolved in distilled water. As an application to *scrofulous tumors*, Biett recommended an ointment, made by triturating 2 grains of the iodide of barium with ½ ounce of lard; applied by friction. *Specific Indications and Uses.* Tonsillar enlargement; scrofulous lymphatic enlargements, scrofulous ophthalmia, with swelling of meibomian glands (Webster); testicular swelling and indurations; 3 x trituration, 2 or 3 grains, 3 times a day.

Barii Bromidum ($BaBr_2 + 2H_2O$). Molecular Weight: 332.34. *Bromide of barium.*—This salt occurs in rhombic, plate-like crystals, colorless, having an unpleasant taste, and dissolving freely in both alcohol and water. It is prepared from a hydrobromic acid solution of barium carbonate.

Barii Sulphas ($BaSO_4$). Molecular Weight: 232.62. *Sulphate of barium, Heavy spar.*—This salt was discovered by Scheele in 1774; its nature was first ascertained by Assessor Gahn. It occurs in considerable quantity, chiefly in veins, and very frequently accompanies galena and gray copper ore; it is also frequently prepared artificially. It often occurs in right-rhombic prisms. Its color is white or flesh-red; it is brittle, commonly in plates, of specific gravity 4.41 to 4.67, odorless, tasteless; is not easily fused; is insoluble in nitric acid, and requires 43,000 times its weight of water at 15.5° C. (60° F) to dissolve it. Heated suddenly it decrepitates; a violent heat converts it into a white, opaque globule. Ignited in powder with charcoal it becomes changed into sulphide of barium, evolving hydrogen sulphide on the addition of hydrochloric acid, and forming a solution of chloride of barium. The several salts of barium are generally prepared from it. This material is extensively employed as an adulterant, or at least a substitute, of white lead, and the artificial salt especially, is consumed in enormous quantities for this purpose by painters, to whom it is known as *baryta* or *barytes*. This must not be confounded with monoxide of barium, which is also known as *baryta*.

BEBERINÆ SULPHAS.—BEBERINE SULPHATE.

Synonyms: *Beberia sulphas, Sulphate of bibirine, Sulphate of bebeerine.*

Source.—An impure sulphate of an alkaloid obtained from nectandra or bebeeru barks. The salt is probably a mixture of *beberine, nectandrine* (this is probably identical with *sipirine*), and other alkaloidal bodies.

Preparation.—The process for obtaining it is essentially the same as that for sulphate of quinine. The bark is at first freed of tannin and coloring matter by boiling it with carbonate of sodium; it is then exhausted by boiling in water acidulated with sulphuric acid, and the alkaloidal matter is thrown down from the concentrated acid liquor by means of carbonate of sodium. The impure bases thus separated are washed, dissolved, and neutralized with weak sulphuric acid, and the solution is treated with animal charcoal, concentrated, filtered again, and finally evaporated in thin layers in flat vessels. Any excess of acid must be carefully avoided, otherwise the salt will be charred on evaporating it to dryness.

Description and History.—The sulphate of beberine of commerce contains both bebeerine and probably *sipirine (sipeerin)*, another alkaloidal principle also discovered by Dr. Rodie. It occurs in thin, somewhat glittering scales of a deep-brownish color (sometimes with a greenish tinge), and forming a yellow powder. It is inodorous, and has an intensely bitter, persistent, and somewhat astringent taste. Like the sulphate of quinine, it requires an excess of acid for its perfect solution; hence the addition of a few drops of diluted sulphuric acid renders its solution more complete. It is also soluble in alcohol. When well prepared the scale-like particles should be glittering and translucent, and when incinerated ought to leave no ash, or a mere trace only. In this way sulphate of calcium, the only important impurity which has been found in it, may be easily detected. When carefully dried it contains 90.83 per cent of base and 9.17 of sulphuric acid. Beberine sulphate is always impure, containing, as above stated, other alkaloids. While it has not been proven that nectandrine and sipirine are identical, it is altogether probable that they are one and the same. The commercial sulphate of beberine contains scarcely "one-third of its weight of the pure alkaloid" (*Pharmacographia*). (See *Nectandra*, *Buxus*, and *Pareira Brava*.)

Action, Medical Uses, and Dosage.—Beberine (and its sulphate) is a tonic and antiperiodic, and is applicable to the same forms of disease as those in which quinine is employed. It increases the appetite, raises the pulse a little, and improves the tone of the constitution generally, with but little tendency to produce ringing in the ears, headache, vertigo, or other nervous symptoms, as is the case with quinine, except when given in large or frequently-repeated doses. It has been used with success in *intermittent* and *remittent fevers*, but is inferior to quinine, although a valuable substitute for it. It has been found of decided benefit in *periodic headache* and other *periodic neuralgias*, as well as in *atonic dyspepsia* and *general debility*. It seems to be specially applicable to persons of a strumous or phthisical habit, and in the latter stages of *phthisis* has strengthened the system, improved the appetite, and checked *night-sweats*. In *menorrhagia*, *strumous ophthalmia*, and in *pregnancy* requiring tonic treatment it has been highy prized by many practitioners. Dr. Scudder (*Spec. Med.*) asserted its specific action upon the uterus, and suggested its use in *menorrhagia*, where the flow is profuse and too frequent. The dose he suggested was from ½ to 3 grains every 3 or 4 hours. The dose of sulphate of bebeerine is from 1 to 3 grains as a tonic and from 5 to 20 as a febrifuge. It may be given in pill with conserve of roses, or in solution. Half a drachm of the sulphate, 25 minims of elixir vitriol, a fluid ounce each of syrup and tincture of orange peel, and 4 fluid ounces of water, mixed together, form an excellent solution for general tonic purposes; of this a tablespoonful may be given 3 times a day, each dose containing about 2½ grains of the salt. Dose of the salt, from 2 to 5 grains.

BELÆ FRUCTUS.—BAEL FRUIT.

The unripe or half-ripe fruit of *Ægle Marmelos*, Correa.

Nat. Ord.—Aurantiaceæ.

COMMON NAMES: *Bèl*, *Bael fruit*, *Indian quince*, *Indian bael*, *Bengal quince*.

Botanical Source.—A large, erect, thorny tree, with a few spreading branches. The leaves are ternate, with crenulate, lance-oblong leaflets, which are dotted to some extent. The terminal leaflet is the largest. The flowers are borne in both small, axillary and terminal panicles, and are quite large and of a white color. The fruit is a hard-shelled, subglobular berry.

History.—This tree abounds in Farther India and Hindustan. It is regarded as a sacred tree by the Hindus, who cultivate it largely in their gardens, and employ the leaves in enormous quantities in Siva worship. Sanskrit poems allude to it as an emblem of fruitfulness and increase, and to destroy it is sacrilege (Dymock). Several parts of the plant are used by the natives, but in England only the partially-ripe fruit is employed. It is official in both the *Pharmacopœia of India* and the *British Pharmacopœia*. From the ripe fruit a kind of thick sherbet is prepared, which, in India, is much esteemed as a laxative. Bael fruit, or Indian quince, is known in Indian vernacular as *bèl*, *bhel*, and *bela*. The fruit resembles the orange in appearance, has a delicious flavor and pleasant odor when ripe. The thick rind of the unripe fruit is astringent, and is used in India for dysentery, diarrhœa, and other bowel complaints. A yellow dye is prepared from the rind when the fruit is ripe.

Description.—The fruit, which has a hard, ligneous, almost smooth rind, is about the size of an orange, and is subglobular in shape. It is divided into from 10 to 15 cells, containing from 5 to 10 wooly seeds, immersed in a tenacious, transparent mucus. In commerce it appears as dried slices, more or less twisted, or in dried fragments of the pulp and seeds, with portions of the rind adherent. The rind is hard, nearly smooth, light-brown or gray in color; the pulp is brittle, yet firm, externally orange-brown or bright red, but on fracture exhibits a nearly colorless interior. It is without odor, and to the taste is mucilaginous, slightly astringent, and scarcely acid. When fresh, however, the fruit has a pleasant flavor, and the rind is aromatic.

Mangosteen, the fruit of *Garcinia Mangostana*, has been substituted in England as an adulterant.

Chemical Composition.—Bael fruit yields its properties to water, either by decoction or maceration. The chemical properties of this substance do not seem to be definitely understood. The pulp yields mucilage and pectin to cold water. Pollock reports tannin in the fruit, and according to Collas about 5 per cent of tannin may be obtained from the ripe fruit. Prof. Flückiger, however, states that neither the higher nor lower salts of iron show any appreciable amount of tannin in the infusion of the fruit. Warden, on the contrary, observes that when both the unripe and ripe fruits are moistened with ferric chloride solution a marked reaction takes place, showing the presence of tannic acid in considerable quantity. This change was most noticeable in the pulpy portions nearest the rind. He also found that acid properties were possessed by the mucilage around the seeds, and that the same also contained calcium (Dymock).

Medical Properties and Uses.—In Malabar the root, bark, and leaves of this plant have refrigerant properties attributed to them, and are considered of great value in *hypochondria*, *melancholia*, *palpitation of the heart*, and in *asthma*. The ripe fruit is very agreeable to the taste, and is used for the removal of *habitual constipation*. A fluid extract of the rind of the unripe fruit may be given in *diarrhœa* and in *dysentery* in doses of from 30 minims to 2 fluid drachms every 2 or 3 hours.

Related Drug.—*Feronia elephantum*, Correa. *Wood apple*, *Elephant apple*. India. Used like bael for *diarrhœa* and *dysentery*. The ripe fruit is employed in *gum* and *throat affections*. The leaves have an odor like anise and are carminative. Externally applied the pulp and dried rind are employed for the *bites of poisonous insects*. A gum obtained from it is substituted for gum Arabic in India, and is used in *intestinal diseases* to overcome tenesmus. The ripe fruit is edible (Dymock). Citric acid in considerable amount may be obtained from the dried fruit.

BELLADONNA.—BELLADONNA.

I. Belladonnæ Folia (*U. S. P.*), *Belladonna Leaves*.—"The leaves of *Atropa Belladonna*, Linné"—(*U. S. P.*).

II. Belladonnæ Radix (*U. S. P.*), *Belladonna Root*.—"The root of *Atropa Belladonna*, Linné"—(*U. S. P.*).

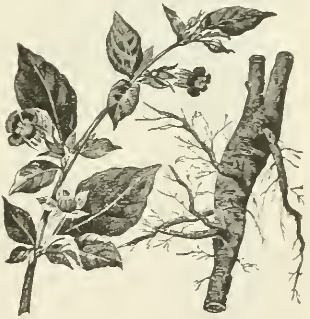
Nat. Ord.—Solanaceæ.

Common Names: *Deadly nightshade*, *Dwale*, *Black cherry*.

Illustration: Bentley and Trimen. *Med. Plants*, p. 193.

Botanical Source.—Atropa Belladonna is a perennial herb, with a thick, branched, fleshy, creeping root, and annual, erect, round, dichotomously branched, leafy, slightly downy stems, about 3 feet high. The leaves are lateral, mostly two together, of unequal size, ovate, acute, entire, soft, of a dull-green color, smooth and borne on short petioles. The flowers are imperfectly axillary, solitary, stalked, large, drooping, dark, dull-purple in the border, paler downward. The calyx is green, 5-parted, permanent, and nearly equal. The corolla is campanulate, with a short tube, and limb divided into 5, shallow, nearly equal segments. Stamens 5; filaments nearly as long as the corolla tube; anthers cordate and 4-lobed; stigma capitate and 2-lobed. The fruit is a 2-celled, many-seeded berry, subtended by the enlarged calyx; it contains reniform seeds (L.—Smith). When bruised the whole plant exhales a fetid odor.

Fig. 39.



Flowering branch and fresh root of Atropa Belladonna.

History.—This plant is common to Europe, growing among ruins and in waste places, blossoming from May to August, and maturing its berries in September. It is also found as far east as Central Asia. It is often found growing in woodlands, and especially in the woods of high elevations, as of mountains. It is cultivated to some extent in this country, in France, and in Britain. The whole plant possesses poisonous properties. The leaves must be gathered while the plant is in flower. The *British Pharmacopœia* directs the leaves (gathered at the beginning of the fruiting season and separated from the stems, and dried with care) of the wild or cultivated plants growing in Britain. The British or imported dried German root is directed under *Belladonnæ Radix*. Leaves in as fresh a state as possible should be employed, as the older leaves are said to absorb moisture, causing decomposition of the active constituents, with the liberation of ammonia. The stems should be rejected, also musty leaves, if the herb is desired for the preparation of the alkaloids, or if a full-strength preparation is desired. The root should be taken up in the spring, or late autumn, from plants at least three years old.

Description.—The *U. S. P.* demands belladonna leaves and root conforming to the following description:

BELLADONNÆ FOLIA (*U. S. P.*), *Belladonna Leaves.*—"Leaves from 10 to 15 Cm. (4 to 6 inches) long, from 5 to 10 Cm. (2 to 4 inches) broad, broadly ovate, equilaterally narrowed into a petiole, tapering at the apex, entire on the margin, smooth, thin, the upper surface brownish-green, the lower surface grayish-green, both surfaces whitish punctate; odor slight; taste bitterish, disagreeable"—(*U. S. P.*).

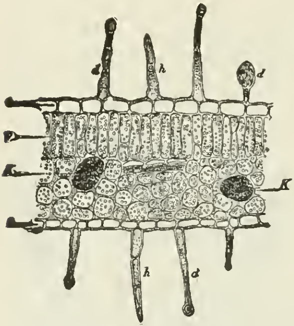
BELLADONNÆ RADIX (*U. S. P.*), *Belladonna Root.*—"In cylindrical, somewhat tapering, longitudinally-wrinkled pieces, 10 to 25 Mm. ($\frac{2}{5}$ to 1 inch) or more in thickness; externally brownish-gray, internally whitish; fracture nearly smooth and mealy, not radiating or showing medullary rays in the thicker roots, only in the layer near the bark; nearly inodorous; taste sweetish, afterward bitterish, and strongly acrid. Roots which are tough and woody, breaking with a splintery fracture, should be rejected; likewise the hollow stem-bases which are sometimes present"—(*U. S. P.*).

From "*Belladonna*," edited by F. B. Kilmer, of Johnson & Johnson, we abstract, by permission, as follows:*

BELLADONNA LEAVES.—*Macroscopically:* "Belladonna leaves are of two sizes, the larger about 1½ d. m. long, the smaller being about one-half this size. They are brownish-green upon the upper surface and gray-green below, broadly ovate or ovate-long, narrowed into a petiole; apex acute or acuminate; margin entire, the petioles and nerves of the underside of the leaf particularly are downy, hairy, and glandulous. Both surfaces of the leaf possess trichomes, numerous cells are apparent, filled with crystal-like contents, giving the leaf the peculiar spotted appearance it possesses. The leaf is membranaceous, odor narcotic, and taste bitter and disagreeable.

Microscopically: "The epidermal cells, on making a surface section, appear undulating. On the under surface the stomata are more numerous, near to which arise trichomes, which tend to cover and protect the stomata by preventing too great evaporation and so assist the work of transpiration. The hairs are of three kinds: (a) Simple-jointed cells; (b) short, glandular cells, with one or more (3 to 4) celled apex; (c) hairs with long stalks and a spherical-celled apex. In the mesophyll are cells containing an innumerable number of granule-like or crystal-like bodies.

Fig. 40.



I. CROSS-SECTION OF LEAF.

e. Epidermis (upper surface).
e. Epidermis (under surface).
p. Palisade cells under which are the mesophyll cells
k. Crystal-containing cells (calcium oxalate in minute crystals).
l. Simple trichome.
d. Head-bearing and gland-bearing trichome.

Belladonna Leaves of the Market: "As found in the market, belladonna leaves, especially the finer grades, when crumpled or broken up, look very much like the mints, but are easily distinguished from them by the narcotic odor and disagreeably bitter taste. They also resemble somewhat the narcotic herbs, stramonium and hyoscyamus, but from these may be easily distinguished.

"Belladonna leaves, compared to the other official leaves of the Solanaceæ, are comparatively smooth and the margin is entire. The upper surface is darker than the lower surface. The undeveloped fruit, a calyx with an unripe berry, is often present.

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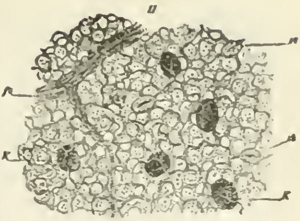
* This monograph contains contributions from the pens of Profs. Henry Kraemer, Charles Rice, John M. Maisch, J. U. Lloyd, J. P. Remington, R. G. Eccles, M. D., H. C. Wood, M. D., W. C. Caldwell, M. D., John B. Smith, A. R. L. Dohme, Robert W. Johnson, and others.

"Stramonium leaves are dark-green and not quite so smooth as belladonna, the hairs shorter, with a many-celled apex, and in the mesophyll are numerous cells containing large, single crystals of calcium oxalate. The perforations and cork formations in the leaves are numerous. The base of the leaf is unequal and does not taper into a petiole. The fruit is a capsule, and very often a few reniform seeds will be found present.

"Hyoscyamus leaves are furnished with long hairs, which tend to become tangled and matted, so giving the leaf a hairy appearance. There is an absence of petiole and a presence of stem-stalks. The fruit is a pyxis enclosed in an urn-shaped calyx. The seeds are much smaller than stramonium.

Fig. 41.



H[illegible] SURFACE-SECTION OF LEAF

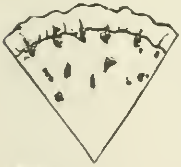
st. Stoma.
fr. Fibro-vascular bundle (spiral vessels).
k. Cells containing crystals.

"Solanum nigrum leaves are much smaller than belladonna, with a repand dentate margin (Wigand).

BELLADONNA ROOT.—*Macroscopic characters.* "The root of belladonna is a fleshy, spindle-shaped, primary root. When fresh it is about 5 decimeters long, and about 5 centimeters in diameter. It then possesses a number of stout branches, the remnants of which are sometimes seen attached to pieces of commercial root. The bark contains the largest amount of alkaloid, therefore roots are selected by careful buyers which possess the larger portion of bark compared to the woody portion. Young roots of but 2 or 3 years are preferred. Chemical analysis shows that the amount of alkaloid in roots collected about the time of flowering is twice as much as in spring, so roots should be collected about the flowering and fruiting season, carefully dried and preserved.

"The commercial root, to hasten the drying, is invariably split into smaller pieces. It occurs in rough, irregular pieces, from a few inches in length to 6, 8, or even 12 and 15 inches, varying in diameter according as the root is split. Externally, it is longitudinally wrinkled, of a pale-brown, or grayish color; internally, brownish, or whitish; odor heavy and licorice-like; taste peculiar, characteristic, sweet at first, and afterward acrid or bitter. The fracture may be mealy, horn-like, or woody, and from these characters may be distinguished 3 commercial varieties:

Fig. 42.

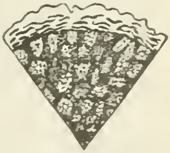


Mealy Belladonna root (cross-section).

1. *Mealy Belladonna.*—" Is lighter externally and internally than the other two, and on cross-section it is of a nearly uniform, dirty-white appearance. The bark is about $\frac{1}{7}$ of the cross-section. At the periphery of the fundamental tissue of the pith are yellowish, vascular bundles scattered apparently indiscriminately. These finally disappear beyond the cambium. Starch is present throughout all the cells of the wood and bark, which is colored blue by iodine. In spring and autumn roots the starch is present in the largest amount.

2. *Horn-like Belladonna.*—" Is very dark. On cross-section it looks brownish and waxy, or horn-like. The bark is separated by an indistinct cambium from the woody portion, of which the fibro-vascular bundles are arranged in single groups, and separated from each other by one or more broad bands of a horn-like tissue (keratrenchym). In the tissues of both the wood and bark occur numerous cells filled with crystal-like contents, appearing to the eye as white spots. This variety looks more like inula root, and is much smaller generally than the other two. The starch grains are replaced by a dark, resinous material.

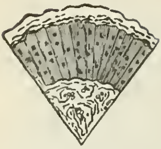
Fig. 43.



Horn-like Belladonna root (cross-section).

3. *Woody Belladonna.*—"This form possesses characters between the other two. The color is more of a light-brown or gray. In cross-section the bark resembles the horn-like

Fig. 44.

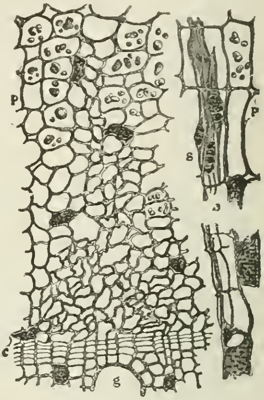


Woody Belladonna root (cross-section).

variety. Inside of the cambium ring is found a prominent, radiating, woody zone, with the largest duct in the very center. The wood bundles have prominent, yellow ducts, and are separated by equally prominent, broad medullary rays. This variety is generally figured in text-books. Starch grains are not so numerous as in the mealy variety, still they are abundant.

Microscopically.—"The cork consists of thin layer of cells, next to which is arranged the cortex. In the latter are numerous cells filled with crystal-like particles, called by Wigand *krystallmehl*, and by Moeller *krystallsand*. These are very common characteristics in both the roots and the leaves of belladonna. The sieve tubes are scarcely perceptible in the bark of young roots, but later are formed in groups more or less wedge-shaped like the wood bundles. These sieve tubes show a beautiful sieve plate in longitudinal section. Stone cells are wanting. As regards the bast in belladonna authors disagree. Wigand (4th ed., 1887) mentions the presence of bast. Prof. Schrenck announced in the *American Druggist* (1887, p. 2) that he had detected bast cells in belladonna root, but found it necessary to remove the starch and stain the cells. The writer examined a mount made by Prof. Schrenck from the belladonna root of commerce (October 16, 1886) mounted in glycerin jelly, and stained apparently with phloroglucin, and readily made out bast cells. Upon further investigation he found it unnecessary to use clearing and staining agents to discover them. The ducts are provided with elliptical pores. The wood bundles are surrounded by wood parenchyma (colored yellow by potassium hydroxide solution), the bundles separated from each other by radially broad, medullary rays. Both the wood and bast parenchyma contain starch. The starch grains are of medium size, in shape round, irregular or hemispherical, or even 2 or 3-sided; single and sometimes compounded of 2 or 4 starch grains. Some of the grains possess a distinct cross-cleft or a stone-like nucleus; in others, however, the stratifications are scarcely apparent. With sulphuric acid alone large numbers of prismatic crystals are produced. With sulphuric acid and bichromate of potassium a greenish coloration is immediately produced, remaining sometimes 24 hours or more."

Fig. 45.



1. *Cross-section of root.*
p. Rind-parenchyma, with starch and crystal cells.
c. Cambium, with a cuneated sieve-tube.
g. Xylem portion (duct).
2. *Radial, longitudinal section of root*
p. Rind-parenchyma.
s. Sieve-tube showing plates.
3. *Tangential section*, showing wood parenchyma and ducts.

Chemical Composition.—The chief and most interesting constituent of belladonna is the alkaloid *atropine* ($C_{17}H_{23}NO_3$) (see *Atropina*), first obtained in crystalline condition from the root by Mein and from the herb by Geiger and Hesse (*Pharmacographia*). On the history and constituents of this plant Mr. Kilmer, the editor of "*Belladonna*" (Johnson & Johnson), offers the following data herewith:

"Galen is the first author who refers unquestionably to the mydriatic action of two species of Solanaceæ. Dr. Ray, in 1686, reported the case of a lady who had placed a belladonna leaf upon a small ulcer beneath the eye and afterwards was annoyed by an excessive dilatation of the pupil. Evers independently, in 1773, discovered the mydriatic power of belladonna. These writers were followed by Davies (1775) and Loder (1796). After this the specific action of belladonna upon the eye became generally accepted. Runge, in 1819, approximately isolated the alkaloid of hyoscyamus and called it koromegyn (meaning magnifier of pupil). In 1830 the apothecary Mein isolated the alkaloid atropine from the root. Independently Geiger and Hesse, in 1832, isolated the crystallized alkaloid from the herb, while Liebig, in 1833, determined its chemical formula."

The main constituents of belladonna are as follows: *Atropine* $(C_{17}H_{23}NO_3)$ (see *Atropina*). *Hyoscyamine* $(C_{17}H_{23}NO_3)$, sometimes the principal constituent of belladonna root. It is convertible into atropine by heat; conversion also takes place in the plant itself. *Atropamine* $(C_{17}H_{21}NO_2)$ is identical with the *apoatropine* obtained by Pesci, in 1882, by the action of nitric acid upon atropine (O. Hesse, 1893). It is convertible into *belladonnine* by the action of HCl or KOH. *Belladonnine* $(C_{17}H_{21}NO_2)$ (Hübschmann) is an amorphous alkaloid, and is obtainable from hyoscyamine or atropine by heating these alkaloids from 120° to 130° C. (248° to 266° F) for several hours. By raising the temperature gradually, transformation takes place with products resulting in the following order: Hyoscyamine, atropine, atropamine, and belladonnine. *Hyoscine* $(C_{17}H_{21}NO_4)$, discovered by Ladenburg in *Hyoscyamus niger*, occurs in belladonna root in small amounts (Schuette, 1892). O. Hesse, in 1893, showed its identity with *scopolamine*, an alkaloid obtained from the root of *Scopolia atropoides*, *B.* and *P.* *S. carniolica*, for which E. Schmidt, in 1892, had found the formula, $C_{17}H_{21}NO_4$. Earlier analyses show the presence in belladonna of *chrysatropic acid* (Kunz), the concentrated solutions of which show green and blue fluorescence, *atrosin*, a red-coloring principle in the root (Hübschmann), succinic acid in the herb, malates, and oxalates, combined with sodium, potassium and magnesium salts, gum, wax, asparagin, chlorophyll (in the leaves), starch, and albuminous bodies.

The Production of Atropine in the Plant.—"Messrs. Schering, in 1888, stated that belladonna roots contain practically only hyoscyamine, and that atropine was a decomposition product produced during the process of manufacture. Drs. Will and Schmidt (1887) proved that the mere contact of an alkali with hyoscyamine was sufficient to produce this change. Dr. Schuette (*Arch. der Pharm.*, 1891, p. 492) found that the same result is produced by repeated crystallization from acidulated water. He also investigated the influence that age and period of vegetation exerted upon alkaloids in the roots, leaves, and berries. He found that fresh roots (1 to 2 years old), collected from a basaltic district, whether gathered in the spring, summer, or autumn, contained only hyoscyamine, but the older roots (8 years and upwards) always contained, besides much hyoscyamine, a little already-formed atropine. Similar results were obtained with roots from old cultivated plants that had been kept for several years. Spring and autumn leaves of belladonna contained principally hyoscyamine, with equal quantities of ready-formed atropine. The unripe berries of the wild plant contained chiefly hyoscyamine and a little atropine, but the ripe fruit contained only atropine. The ripe berries of cultivated plants, however, yielded both hyoscyamine and atropine. His investigations upon other members of the Solanaceæ indicated that hyoscyamine is the primary base from which other alkaloidal products may be formed."

Conclusions.—"Regarding the time of collecting and variation of alkaloid in the plant, investigators have drawn the following conclusions:

"The first year's growth of belladonna contains but one-half the quantity of atropine present in older plants, and so are unworthy of collection. Young roots contain only hyoscyamine. The older roots contain both hyoscyamine and atropine, the latter predominating. In young leaves atropine is present, but hyoscyamine is the predominating alkaloid. The length of keeping after gathering appears to have no influence on the alkaloid present (Maisch). From the second to the fourth year the quantity of alkaloid is fairly uniform. At these ages, and during the period of flowering, the plants should be collected. The plant before flowering, is not rich in active principle, but at the period of flowering the full development is reached and maintained, both in roots and leaves (Gerrard). Wild-grown belladonna contains a larger quantity of alkaloid than the cultivated kind. The process of flowering and leafing does not exhaust the root of its alkaloid, there being a simultaneous development in the root and leaf; therefore the roots may be gathered at the same time as the leaf.

"Gerrard's analysis of the freshly-gathered plant shows the highest percentage of alkaloid in the leaves; following them the root, fruit, and stem, and the wild plant contains the largest amounts of alkaloids. Later investigators, however, have shown that the root will show a much higher average. The results of analysis of the commercial dry root and leaf of belladonna indicate that the roots yield a much higher percentage of alkaloid than the leaves (.82 per cent has been found). A chalky soil favors the formation of atropine, which may account, to some extent, for the superiority of the English leaf. Belladonna leaves in pressed packages several years old do not show evidence of loss of alkaloids (Lyons). Both the root and leaf of belladonna show great variations in strength, and, as has been said, appearance alone is not a sufficient criterion as to the relative value of one lot as compared with another. The peculiar acid and acrid taste of belladonna, which is more apparent as the sense of taste is cultivated, together with general physical characters already described, are fair indications to an expert of the value of a sample of belladonna. Chemical analysis is, however, the only certain and reliable test as to the full value"—(*Belladonna*).

Action and Toxicology.—Belladonna is an energetic, narcotic poison. While fatal to carnivorous animals and to man, the same doses have but relatively little effect upon fowls and herbivora. Dogs, however, stand relatively large amounts of this drug and its alkaloid. Children are often poisoned by the berries, mistaking them for cherries. In large doses, according to Pereira, it acts upon the cerebro-spinal system, as manifested by the symptoms, "dilatation of the pupils (mydriasis), presbyopia, or long-sightedness with obscurity of vision, or absolute blindness (amaurosis), visual illusions (phantasms), suffused eyes, occasionally disturbance of hearing (as ringing in the ears, etc.), numbness of the face, confusion of head, giddiness, and delirium. The mouth and throat become dry, with difficulty of deglutition and articulation, constriction about the throat, nausea, vomiting, swelling, and redness of the face, and sometimes irritation of the urinary organs, or an exanthematous eruption." If the dose be very large, the above-named symptoms will be produced, but in a more violent form, with extravagant delirium, followed by sopor. Convulsions are rarely present; when it causes death it is commonly by coma. The effects of belladonna and atropine are practically identical. Therefore, for further remarks concerning the action of this drug, see ATROPINÆ SULPHAS.

The proper remedies in poisoning by belladonna are the stomach-pump, emetics and purgatives, cold to the head; and in the comatose stage, ammonia internally, with external stimulants, electro-magnetism, etc. (C.) Belladonna and opium appear to exert antagonistic influences, especially as regards their action on the brain, the spinal cord, and heart; they have consequently been recommended and employed as antidotes to each other in cases of poisoning; this matter is now positively and satisfactorily settled; hence in all cases of poisoning by belladonna the great remedy is morphine, and its use may be guided by the degree of pupillary contraction it occasions. Bouchardat and Suiz Rioya recommend iodine as an antidote, even when the symptoms of poisoning with belladonna are of long duration; the compound solution of iodine may be given for this purpose.

Medical Uses and Dosage.—Therapeutically employed belladonna exerts precisely opposite effects from those of its toxic doses. Large doses paralyze, small doses stimulate, the nervous system. Belladonna, as chiefly used in our school, is selected in conditions in which there is *impairment of the capillary circulation* in any part of the body, *with congestion*.

Dr. J. Harley, from a series of experiments instituted by himself, was led to consider belladonna: 1. As a direct and powerful stimulant to the sympathetic nervous system, or to the heart, being superior to all agents in its simple, direct, immediate, and powerful influence in exalting the force and rapidity of the heart's action, and therefore useful in cases where there is a depression of the sympathetic nervous influence, as in *syncope* from asthenia or shock; in the *collapse of cholera;* in *failure of the heart's action from chloroform*, or other cardiac paralyzers. 2. As a diuretic in cases of suppression of urine, whether accompanied by uremic symptoms or not. He has likewise found it efficient in *acute nephritis*, in which it calms the nervous irritation, and at the same time contracts the dilated blood-vessels; in *chronic albuminuria*, in which it stimulates the kidneys to healthy action, and diminishes the albumen gradually. He also considers it useful in *rheumatic fever* and in the *uric and lactic acid diathesis*. According to Prof. Brown-Sequard, belladonna diminishes the blood in the spinal cord, and hence diminishes the vital properties of it and its nerves; dilates the pupil, causes the secretion of milk to cease; is useful in *strangulated hernia*, *nocturnal incontinence of urine*, etc. It has a depressant influence upon the pneumogastric nerve, excites the sympathetic, depresses the cerebro-spinal system, touches the secretions, and is slightly aperient. It imparts tone to most involuntary muscles, causes wakefulness, restlessness, is a powerful excitant of the blood-vessels, and in large doses causes delirium; it is useful in external *neuralgia*, in *congestive headache*, and *coma*, with contracted pupil, in *paraplegia*, with symptoms of irritation of the motor, sensitive and vaso-motor or nutritive nerve-fibers of the spinal cord, or of the roots of its nerves, as in *spinal congestion*, *meningitis*, *myelitis*, etc. It is a dangerous agent in *paraplegia*, without symptoms of irritation, as in cases of white softening, or of the reflex paraplegia.

Prof. J. M. Scudder, who based his investigations upon the experiments of Brown-Sequard, and to whom we are indebted for the chief indications for the use of belladonna, employed it to relieve congestion of the nerve-centers, in which malady he considered it a specific wherever there is an enfeebled circulation in the cerebro-spinal centers, as manifested by enfeebled innervation, sluggish circulation, tendency to coma, and to congestion of internal organs, a soft, oppressed pulse, dilated pupils, pasty, soft skin, coldness of the extremities, and involuntary micturition, acting by causing contraction of the blood-vessels of the spinal cord and the capillary blood-vessels, and which action may be effected by stimulation through the sympathetic nervous system. He adds from 5 to 10 minims of specific belladonna to 4 fluid ounces of water, of which the dose is a fluid drachm every 1, 2, or 3 hours, according to the symptoms and influence of the agent (see *Diseases of Children*). In doses large enough to dilate the pupil it exerts an opposite influence, and then becomes useless as a remedy, and fails to produce its specific action. The indications for this agent as a specific are a full, oppressed pulse, tendency to congestion, diminished heat of parts distant from the heart, a labored, slow, and imperfect respiration, expressionless countenance, dullness, hebetude, sleeping with the eyes partly open, drowsiness, dilated or immobile pupil, and coma. A deep color pervades the skin—a duskiness often—which, when the finger is drawn over it, is effaced, leaving a persistent, white streak, the blood very slowly returning. This is one of its best indications in the severer exanthemata. Involuntary urination and copious passages of limpid urine are also indications for its use; also deep aching in loins or back, with a feeling of fullness. When much pain is present, it may be combined with specific aconite. We employ minute doses of belladonna with confidence in congestive disorders. Throbbing, *congestive*, or *nervo-congestive headaches* are quickly relieved by it; or it may be a dull, heavy headache, with a drowsy feeling, as if, were it not for the pain, the patient would drop off to sleep. While it is a remedy for blood stasis, due to dilated capillaries in any part, its operation is perhaps more pronounced in impairment of circulation in the nerve-centers. In *cerebral* or *spinal congestion*, as evidenced by dullness and coma, it is the first remedy to be selected. In *chronic brain diseases*, with dizziness, drowsiness, and dull, heavy aching, with a sense of fullness in the head, its effects are pronounced, and when the dull eye, with dilated pupil and drowsiness, are present in threatened *apoplexy* this remedy should be selected.

Perhaps with no remedy is the size of dose so important as with belladonna. For the above-mentioned conditions and those similar to follow the proportions above mentioned are preferred. Webster, however, calls attention to the fact that the 3 x dilution (flʒss to flʒj; aqua, fl℥iv. Teaspoonful every two or three hours) serves better in certain nervous disorders. The condition in which he uses belladonna in these attenuated doses is in "nervous exaltation—great irritability and impressionableness of all the senses." Such a condition accompanying spasmodic disorders—*chorea* and *epilepsy*—indicates it, while in *febrile disorders*, where the "hyperæsthesia of the senses amounts to delirium," he declares it the remedy. According to this author, wild and furious delirium is met by the attenuations; dullness and hebetude by the larger doses above-mentioned, keeping within the bounds indicated by Prof. Scudder.

Belladonna is one of the most important remedies for *bladder* and *kidney diseases*. It stimulates and at the same time relieves *irritation of the urinary tract*. Both the solid and watery constituents of the urine are increased in amount. It is the remedy in *urinal incontinence* in small children when the fault depends upon a poor pelvic circulation or chronic irritability of the bladder (Locke). Should the latter condition result from rectal ascarides santonine will correct the trouble. It seems best adapted to that dribbling of urine in the young, which occurs chiefly during the day. We have seen marked benefit from minute doses of belladonna in children who urinate every twenty minutes or half hour, marked pallor of countenance and dullness of eye being present, and the condition evidently depending upon "a cold." *Diabetes insipidus* is well treated by applying a belladonna plaster and administering the drug internally. It is the remedy in the congestive and early stages of *kidney disease*, with a sense of fullness, weight, and dragging in the loins. *Tubular nephritis* (early stage), *scarlatinal nephritis*, and all cases of *renal capillary engorgement* are promptly benefited by belladonna. Belladonna is well known to cause dryness of the mouth, and in full doses it checks salivation, especially in that salivary overactivity accompanying *pregnancy*. Full doses likewise check the *exhaustive sweating of phthisis* and other debilitating diseases. Its good effects in this direction, however, are overbalanced by the dry condition of the mouth and fauces produced.

Belladonna is a remedy for *pain* and for *spasm*. Certain forms of *neuralgia*, particularly *trigeminal neuralgia*, are relieved by ordinary doses of belladonna. *Intercostal*, *visceral*, and *sciatic neuralgias* are sometimes amenable to it. If there be excitation of the circulation and increase of temperature aconite should be given with it. It overcomes spasm of the involuntary, but is less effectual in spasm of the voluntary, muscles. *Spasm of the anus, biliary spasm, uterine, cystic, intestinal* and *urethral spasms*, and *spasm of the ureters* are relieved by it. Such of these parts as can be reached should be treated locally with the extract. It is a remedy for *spasmodic asthma*, *whooping-cough*, and *nervous cough* from laryngeal irritation. In whooping-cough it is usually indicated in the latter stage, where it lessens the severity of the paroxysms and increases the intervals between them (Locke). *Obstinate constipation*, *spasmodic colic*, *lead colic*, *spasmodic constriction of the intestines*, and *spasmodic dysmenorrhœa* are conditions often met with belladonna. It is often serviceable in *chorea* and in *epilepsy*, with congestion. It is also recommended in *infantile convulsions* of an epileptiform character. *Hay fever* is said to be palliated by belladonna, and its influence is good in *spermatorrhœa*, with enfeebled pelvic circulation. It is useful, but less valuable than morphine, in *puerperal convulsions*. In various forms of *sore throat* belladonna is an important remedy. In *non-diphtheritic faucial inflammation*, with redness, swelling, soreness, difficult deglutition, with dryness of the throat and more or less fever, it should be administered in alternation with aconite every half hour. If given early it often greatly benefits in *diphtheria*, interfering with the formation of the membrane. In *non-vesicular erysipelas*, with burning and deep redness of the skin, where the subcutaneous tissues are not much involved, it is an efficient remedy.

Perhaps in no class of diseases has the action of belladonna been appreciated more than in the *exanthemata*. That it is a prophylactic, in minute doses, against scarlatina has long been maintained. On the other hand this view has been vehemently assailed. Whether true or not, and testimony is mainly in its favor, it certainly can do no harm, and if scarlet fever supervenes an advantage will have been gained in its early administration. In both *scarlet fever* and *measles* it is nearly always indicated, and its effects are certain and prompt. The more congestive the form the more satisfactory the effects from this remedy. It awakens the little patient from his stupid or drowsy state, or even from unconsciousness, quiets delirium, and favors the eruption and renal activity. Undoubtedly it also possesses some power over the poison producing the disease. *Urticaria* and *erythema* are often relieved by it, and it is a remedy in all *febrile states tending to congestion*. It is particularly a child's remedy, but must be cautiously used. We have observed the scarlatinoid rash from very minute doses of specific belladonna.

Belladonna is valued in the complications attending or following scarlatina. It readily relieves these troubles and tends to prevent sequelæ. Small doses of the specific medicine should be administered every hour.

The antagonism of belladonna and opium now seems well established, both physiologically and clinically. It is therefore, like atropine, used as an antidote to *opium* and *morphine narcosis*, as well as for the toxic action of *physostigma* and its alkaloid, *eserine* (*physostigmine*). Here it must not be used to over-stimulation, for its narcotic effects are to be avoided. Small and oft-repeated doses of belladonna (or atropine hypodermatically) should be given until respiration becomes stronger, the pulse more forcible, and pupillary dilatation begins. Here the action should be maintained until the danger is past.

Externally it was formerly applied in extract to the parts around the eye, to dilate the pupil, before operating for *cataract*, in *iridectomy*, to relieve *internal ocular pressure* in *ulceration of the cornea*, and also in *iritis* to prevent adhesions. For these purposes a drop or two of an aqueous solution of the extract is sometimes placed upon the conjunctiva. The sulphate of atropine has now superseded the use of the extract. Both locally and internally belladonna is a prompt agent for the relief of *photophobia*. The ointment, or extract, has also been applied locally in *spasmodic stricture of the urethra*, and of the sphincters of the bladder and rectum, in *great pain along the female urethra*, in *strangulated hernia*, *spasmodic contraction of the uterus*, *hemorrhoids*, etc. Belladonna plasters, or the extract with vaseline, are applied to relieve pain in forming *abscesses*, *recurrent boils*, *neuralgia*, and *lumbago*, with gratifying results. No remedy is of more value to check the *secretion of the mammary gland* when prompt action is desired. One part of the specific may be added to 3 parts of glycerin, and the breast painted with it once or twice a day. Care should be had to see that the surface is unbroken or constitutional effects will be produced. A belladonna plaster over the heart relieves pain in that organ. The following has been recommended in *neuralgia* of the uterus: Mix together 1½ grain of alcoholic extract of belladonna and ¾ of a grain of opium. Place the two extracts in the center of a little pledget of carded cotton, and fold it up so as to inclose the extract; tie it up with a very strong thread, and leave a double thread 8 inches long attached to it. The plug is to be introduced into the vagina by the physician or patient, and placed upon the neck of the uterus, where it is to be retained from 12 to 24 hours. In very *painful menstruation*, accompanied by *leucorrhœa*, from 8 to 15 grains of tannic acid, or extract of geranium, may be added to the tampon.

Belladonna is said to retard *schirrous growths*, and when applied to *cancerous tumors* it relieves pain. It is a remedy for *local* or *external inflammation*, *acute mastitis*, *inflammatory glandular swelling*, *sympathetic buboes*, *gouty* and *rheumatic inflammations*, etc. Apply the belladonna plaster.

Dose of the powdered leaves, 1 to 2 grains once or twice a day, and gradually increased till the peculiar effects of the medicine are produced; of the extract, ¼ of a grain to 1 grain; tincture of belladonna, 1 to 7 minims; fluid extract of belladonna, 1 to 2 minims; specific belladonna, gtt. v to x; to aqua, ℥iv. Teaspoonful every 1 to 3 hours for congestive states and general uses; for nervous disorders, with furious delirium, specific belladonna (3 x dilution), ʒss to ʒi; to aqua, fl℥v. A teaspoonful every 2 or 3 hours.

Specific Indications and Uses.—Dull, expressionless face, dilated or immobile pupils, dullness of intellect, impaired capillary circulation of skin or internal organs; drowsiness, with inability to sleep on account of pain; cold extremities, dusky, bluish face and extremities; skin soft, doughy, or pasty; circulation sluggish, with soft, full, oppressed, and compressible pulse; slow, labored, and imperfect breathing; sleeping with eyes partially open; hebetude; coma; urinal incontinence; copious passages of limpid urine; deep aching in loins or back, with sense of fullness. The remedy for congestion, with dilated capillaries; a deep redness of the skin, effaced by the finger, leaving a white streak, the blood slowly returning to the part; spasm of the involuntary muscles. In 3 x attenuation the remedy for nervous excitation, with wild and furious delirium; also in pallid countenance, with frequent urination.

Related Species and Adulterants.—1. *Adulterations or Admixtures of Root*: "JAPANESE BELLADONNA (*Scopolia Japonica*, Maximowicz) is a rhizome from 5 to 10 d. m. in length, and on an average 1 d. m. in diameter, cylindrical, slightly compressed, rarely branched or knotty; on the upper surface marked by circular, slightly alternate stem-scars. Externally brown, internally paler, speckled with numerous white dots; odor mousy and narcotic.

"SCOPOLIA CARNIOLICA, Jacquin, is obtained from Bavaria, Austro-Hungary, and southwestern Russia. The genus Scopolia is interesting, as it forms a connecting link between hyoscyamus and atropa. Scopolia is a rhizome and resembles the genus atropa in containing peculiar, crystal-like contents; but they are less prominent. Neither the bark nor the fibrovascular bundles are so large or so numerous. The starch grains are likewise smaller. There is a close alliance in the anatomy of these two plants, but all of the important characters are less pronounced than in belladonna. Belladonna scopolia is also a rhizome, and, like Japanese belladonna, may be distinguished from true belladonna, which is a root. Where a preparation claims to represent the Pharmacopeia, which explicitly calls for the use of true belladonna, this drug should not be used. Messrs. W. H. Cole & Co., drug merchants. London, make the statement that "*Scopolia carniolica* is always picked and rejected as useless by makers of atropine."

ELECAMPANE (*Inula Helenium*, Linné) is the root of Inula. This root possesses resin cells, the taste is aromatic, and it is stained yellow by iodine—being free from starch.

MEDICAGO ROOT (*Medicago sativa*, Linné) has been noticed as an adulterant in Europe. It is distinguished from belladonna by a solid crown; the bark is thinner, and the meditullium is tough and woody and traversed by numerous fine medullary rays.

MARSHMALLOW (*Althæa officinalis*, Linné) is said to be used as an adulterant for belladonna. It resembles the young uncut root. It is easily distinguished by its radiating wood, numerous bast fibres and mucilage. Holmes noted that belladonna root of the market had been found to contain as high as 50 per cent marshmallow root. It has been stated that some time ago the herbalists in Madrid offered for sale as belladonna a plant which was not belladonna, nor even belonging to the order Solanaceæ. It was called in the Madrid market "Belladonna Silvistre de la casco de campo ares botanica cucubalus" (*A. P. A.*, Vol. 21).

LAPPA (*Arctium Lappa*, Linné) root is sometimes admixed with belladonna. It is distinguished by its peculiar pith, its distinct radiating bark and being colored yellow by iodine and blue by ferric chloride" (Kilmer, in *Belladonna*). Mullein, foxglove and henbane leaves are said to be occasionally present as admixtures.

Scopolia carniolica (*Hyoscyamus Scopolia*, Linné) Jacquin and *Scopolia Japonica*, Maximowicz. The first of these plants has been shown to contain the principal constituents of belladonna, namely: Atropine, hyoscyamine, hyoscine (scopolamine); furthermore choline and a fluorescent body, *scopoletin* (E. Schmidt), and has been used in this country for the production of atropine and in the preparation of belladonna plasters. The identity of *scopolamine* (scopoleïne) ($C_{17}H_{21}NO_4$) and *hyoscine* is above alluded to (see *Belladonna constituents*). Boiling with baryta water decomposes scopoleïne into *atropic acid* ($C_9H_8O_2$) and crystalline *scopoline* ($C_8H_{13}NO_2$), which E. Schmidt believes to be identical with *methyl-æsculin*. The alkaloid scopoline may be synthetically combined with organic acids to form a series of compounds called *scopoleines*, of which scopolamine is a member (compare *Tropëines* under *Atropina*). Scopoline is declared a more powerful mydriatic than atropine, causing dilatation sooner and lasting longer than that from the latter body. Internally, according to Sir Dyce Duckworth, it fails to affect the pupil and does not, like belladonna, produce dryness of the throat. Mr. Gordon Sharp (*Brit. Med. Journ.*) states that his personal experience leads him to believe that scopolamine, hyoscine, daturine and duboisine differ but little in effects from atropine (E. M. J., 284, 1896). The drug needs further study.

II. *Other Mydriatic Plants and Alkaloids*. *Anisodus luridus*. Himalaya Mountains. A solanaceæ containing *atropine* and *hyoscyamine* (Siebert, 1890).

Atropa Mandragora, Linné (*Mandragora officinalis*, Miller; *Mandragora vernalis*, Brotero) and *Mandragora autumnalis* are Southern European stemless plants known as *Mandrake*, or *Mandragora*. Their roots, which are seldom seen in America, are sharp, bitter and narcotic. The root of *Atropa Mandragora* is spindle-shaped, and often divided below into two or three forks so as to somewhat resemble the human shape. On this account animal sensations were attributed to it by the ancients, who also fabulously declared that when torn from the earth it uttered shrieks like those of a human in distress. Dr. T. H. Silvester (1848), according to Lindley, was the first in recent years to call attention to the fact that it was formerly used like chloroform and other anæsthetics now are, so that operations might be painlessly performed. Dioscorides describes the use of wine of mandragora before actual cautery and even amputation, and that a suppository of the juice and also emanations from the fruit were employed to induce sleep. A vulgar superstition attributed the power of promoting fecundity to amulets made of it. Botanically and therapeutically mandragora is related to belladonna. It contains two mydriatic alkaloids—one of which, called *mandragorine* ($C_{17}H_{23}NO_3$) is isomeric with atropine (Crouzel). This is without odor or color, and is deliquescent. Alkalies do not convert it into atropine. Mandragora and its alkaloids are not used in this country.

BENZENUM.—BENZENE.

FORMULA: C_6H_6. MOLECULAR WEIGHT: 77.82.

SYNONYMS: *Benzol*, *Benzole*.

Source, History, and Preparation.—The name *Benzene* given to this substance should not be confused with that of the official *Benzin*, which is an entirely different substance and of an entirely different origin (see *Benzinum*). The name *benzol* would be preferable for benzene, but is rejected in chemical nomenclature on the ground that the ending "ol" indicates alcohols or phenols whereas benzene is a hydrocarbon. It is accepted in the parlance of chemical industry, however, to designate as *benzene* the chemically pure compound C_6H_6, while the term *benzol* is reserved for the commercial product, which contains mainly benzene and varying quantities of toluene (C_7H_8), xylene (C_8H_{10}), and other homologues

(Sadtler, *Handbook of Industrial Organic Chemistry*). Benzene is one of the products of the destructive distillation of wood and coal. Its vapor occurs in the *illuminating gas* manufactured from coal, and in liquid form it is one of the constituents of wood- and coal-tar. It is obtained from coal-tar on a large scale by fractional distillation very much resembling the process by which the rectification of alcohol is effected (see *Alcohol*). Most of the benzene is contained in the portion distilling below 170° C. (338° F.), and is called *light oils* or *crude naphtha*; an aqueous layer of ammonia water likewise results, separating out from beneath the oils. By redistilling the light oils drawn off from the aqueous layer, three fractions are obtained—one below 110° C. (230° F.), another from 110° to 140° C. (230° to 284° F.), and a third from 140° to 170° C. (284° to 338° F.) The first fraction contains the bulk of benzol, the exact boiling point of which is 80.5° C. (176.9° F). This fraction is purified by treatment with concentrated sulphuric acid, whereby olefines and empyreumatic resins are removed; the acid treatment is followed by caustic soda, then by water. The resulting oil is again rectified, and yields 90 *per cent benzol*, which is, by Allen's definition, a benzol, 90 per cent of which distills over before the temperature of 100° C. (212° F.) is reached (S. P. Sadtler). The residue is added to the second fraction, boiling between 110° and 140° C.; this, after treatment with sulphuric acid and with alkali as above, is again distilled, yielding 50 *per cent benzol* (the definition of which is analogous to that of 90 per cent benzol).

The fraction distilling between 140° and 170° C., after chemical purification, is redistilled and yields *solvent naphtha*. A 90 per cent benzol of good quality consists, according to Allen, of "about 70 per cent benzene, 24 per cent toluene, including a little xylene, and 4 to 6 per cent of bisulphide of carbon and light hydrocarbons" (S. P. Sadtler, *Handbook of Industrial Organic Chemistry*).

Chemically pure benzene may be prepared by repeated fractional distillation of 90 per cent benzol, collecting only the fraction between 80° and 85° C. (176° and 185° F.), and finally subjecting the liquid to low temperature whereby benzol becomes solid and may conveniently be purified by pressure. An absolutely pure benzene is obtained by distilling benzoic acid with lime, the process being represented by the following equation: $C_6H_5.COOH+CaO=C_6H_6+CaCO_3$.

Description, Chemical Composition, and Test.—Benzene is a very mobile, inflammable, highly refractive liquid of an ethereal odor, boiling at 80.5° C. (176.9° F.), and having a specific gravity of 0.8991 at 0° C. (32° F.) and of 0.8841 at 15° C. (59° F.). It congeals at 0° C. (32° F.) and melts at 6° C. (42.8° F.). It is scarcely soluble in water, but easily soluble in alcohol and ether. It is an excellent solvent for resins and fats; also for phosphorus, iodine and sulphur. Commercial benzene contains *thiophen* (C_4H_4S) as a regular constituent, which was discovered, in 1883, by Victor Meyer. A mixture of nitric acid and sulphuric acid converts benzene into *nitrobenzene* (*nitrobenzol*), which has a bitter, almond-like odor. By this reaction benzene is easily distinguished from petroleum benzin (see *Benzinum*). Benzene (C_6H_6) has proved of the utmost theoretical and practical importance, it being the compound from which the vast class of *aromatic organic compounds* is derived.

Uses.—Benzene is employed in the arts on account of its power as a solvent for fats, resins, alkaloids, etc. Its most extensive application is in the manufacture of nitrobenzene, and of aniline and its derivatives; hence the importance of benzene in the industry of the coal-tar dyes (see *Anilinum*).

Related Products.—*Toluene* ($C_6H_5.CH_3=C_7H_8$). Molecular weight: 91.79. Toluene is the next higher homologue of benzene. Its boiling point is between 111° and 112° C. (231.8° and 233.6° F.), and is contained in the *light oils* resulting from the fractional distillation of coal-tar, from which source it may be isolated by proper rectification. It is also a constituent of balsam of Tolu, from which it may be obtained by dry distillation (see *Balsam of Tolu*).

BENZINUM (U. S. P.)—BENZIN.

SYNONYMS: *Æther petrolei*, *Petroleum benzin*, *Benzine*, *Petroleum ether*.

"A purified distillate from American petroleum, consisting of hydrocarbons, chiefly of the marsh-gas series (C_5H_{12}, C_6H_{14}, and homologous compounds). Benzin should be carefully kept in well-stoppered bottles or tin cans, in a cool place, remote from lights or fire" (*U. S. P.*).

Preparation and Purification.—Benzin is one of the products obtained when American crude petroleum, as it is found in Pennsylvania, West Virginia, Ohio, Kentucky, etc., is fractionally distilled for the purpose of purification. The first distillation yields 12 per cent of an impure fraction containing the benzin. This is again subjected to fractional distillation. As thus obtained the crude product has an objectionable odor which may be removed by shaking the benzin with sulphuric acid, or with lime. Grazer employs the mixed solutions of sulphuric acid and potassium bichromate. Beringer employs potassium permanganate, sulphuric acid, and soda (see *A. J. P.*, 1890, p. 6, for process).

Description.—This substance must not be confounded with *benzene* (*benzol*), which see. Benzin is thus described in the *U. S. P.*: "A transparent, colorless, diffusive liquid, of a strong, characteristic odor, slightly resembling that of petroleum, but much less disagreeable, and having a neutral reaction. Specific gravity: 0.670 to 0.675 at 15° C. (59° F.). Boiling point: 50° to 60° C. (122° to 140° F.). Insoluble in water; soluble in about 6 parts of alcohol, and readily soluble in ether, chloroform, benzol, and fixed and volatile oils. Benzin is highly inflammable, and its vapor, when mixed with air and ignited, explodes violently" (*U. S. P.*).

Chemical Composition and Tests.—Benzin consists chiefly of *pentane* (C_5H_{12}), *hexane* (C_6H_{14}), and *heptane* (C_7H_{16}), the former predominating in the benzin official in the *U. S. P.* "On evaporating benzin from the hand, it should leave no odor, and on evaporating it from a warmed dish, it should leave no residue (absence of heavy hydrocarbons). When it is boiled for a few minutes with one-fourth its volume of spirit of ammonia, and a few drops of silver nitrate T.S., the ammoniacal liquid should not turn brown (absence of pyrogenous products and sulphur compounds). If 5 drops of benzin be added to a mixture of 40 drops of sulphuric and 10 drops of nitric acid, in a test-tube, the liquid warmed for about ten minutes, and then set aside for half an hour, on diluting it, in a shallow dish, with water, it should not evolve the bitter-almond-like odor of nitro-benzol (difference from, and absence of, *benzol*)"—(*U. S. P.*). On account of its higher price benzene (frequently called benzol) is not likely to be an adulterant of benzin.

Pharmaceutical Uses.—Benzin is an excellent solvent for rubber, fats, some resins, and many of the alkaloidal bases. Fixed oils may be removed from powdered drugs by it, while volatile oils may also be prepared by percolating the drug containing them with this fluid. In some pharmacal operations it is employed in place of ether, but its solvent power on proximate plant constituents is so different as to render it unsafe in many cases where the product contains other bodies than oils, as, in the pharmaceutical oleoresins. It is largely used in the arts as a solvent, and on account of its resemblance in many respects to turpentine it is substituted for that solvent in painting and other operations.

Action, Medical Uses, and Dosage.—Vapors of benzin are reputed destructive to insect life, and in large doses its effects are said to resemble those of nitrobenzole. Mental confusion, dizziness, insensibility, convulsions, and intoxication as from alcohol, or coma are among its effects. By inhalation it has been used to mitigate the symptoms of *pertussis*; internally in *fermentative dyspepsia* and *trichinosis*. Locally it acts somewhat as an anæsthetic, giving relief to *neuralgic* and *rheumatic pain*. *Boils* are said to be aborted by its application, and it has been considerably employed in *parasitic skin diseases*. While it kills the itch-insect, it fails to destroy the eggs. Dose, 5 to 15 minims in capsule, in emulsion, or on sugar.

BENZOINUM (U. S. P.)—BENZOIN.

"A balsamic resin obtained from *Styrax Benzoin*, Dryander"—(*U. S. P.*).

Nat. Ord.—Styraceæ.

COMMON NAMES: *Benzoin*, *Gum benzoin*, *Gum Benjamin*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 169.

Botanical Source.—Styrax Benzoin is a tree from 50 to 70 feet high, with round, tomentose branches. The leaves are alternate, petiolate, oblong, entire, acuminate, smooth above, tomentose beneath, a palm long; the petioles are round, striated, tomentose, very short, and channeled. The flowers are on one side, in compound, axillary racemes, nearly the length of the leaves; the common footstalks are tomentose; the partial alternate, spreading and tomentose. The calyx campanulate, very obscurely 5-toothed; outwardly tomentose; above a line in depth. The petals, numbering 5, are linear, obtuse, outwardly gray with very fine down, and four times longer than the calyx. Stamens 10; filaments inserted into the receptacle, rather shorter than the petals, beneath connate into a cylinder of the length of the calyx, and ciliated on the upper part below the anthers. The anthers are linear and longitudinally adnate to the petals. The ovary is superior, ovate and tomentose; the style filiform and longer than the stamens. The fruit is a globose drupe, containing 1 or 2 nuts, angular, concave on one side and convex on the other (L.).

History.—This beautiful tree presents a handsome appearance with its conspicuous crown of large spreading branches, bearing deep-green leaves, hoary white on the under surface. Its flowers are either white or reddish. The tree is indigenous to Sumatra (where it is cultivated), Java, and Borneo. A kind of gum is also produced in Siam and Cochin China, while along the east bank of the Mekong, it is said to be produced from the neighboring cassia forests. The botanical name of the tree, which is the source of the Siam gum, is unknown. The greater portion of the commercial benzoin is collected in the northern and eastern portions of Sumatra, and comes into English markets as *Gum Benjamin*, the tree from which it is derived being known as the Benjamin, or Benzoin, tree. This resinous balsam is obtained by making incisions into the bark of trees 6 or 7 years old, from which the balsam flows in the form of a thick, milky, resinous juice, which is allowed to remain until sufficiently hardened, when it is collected and new incisions made. The trees yield about 3 pounds of resin annually for a period of about a dozen years. The first 3 years' yield gives a superior product, containing a greater quantity of white tears, and is designated by the natives as *Head benzoin*. A browner resin, inferior to the above, which exudes during the remaining 7 or 8 years, is known as *Belly benzoin*. The least valuable product, *Foot benzoin*, is that obtained by cutting down the tree, splitting the wood and scraping it. In this way it becomes mixed with foreign matter, such as wood, bark, etc. Benzoin appears in commerce in the form of square masses, having been melted by sun heat or hot water and poured into square receptacles. While the resin is known to the Malays by the above names (which correspond to superior, medium, and inferior) it is known in commerce as two varieties—*Siam benzoin* and *Sumatra benzoin*.

Description.—Benzoin occurs in market in several grades, as regards the amount of milky-white tears contained in the mass. The Siam gum is regarded the most valuable, containing less foreign impurities than the Sumatra variety, the inferior grades of which are sometimes bark and but little resin.

SIAM BENZOIN comes in the form of square blocks having opaque, milky tears, often an inch or two in length, loosely adherent to each other. Usually, however, the tears are smaller, the mass more compact, the tears being imbedded in an amber-colored, or brown, resiniform material. Specimens containing the translucent resinous matter and very small tears, in appearance, are said to resemble Scotch granite. The tears show internally a semi-translucent, lamellated structure. Even the opaque tears become discolored and translucent by age. The resin is brittle, but may be readily softened by mastication, and has a pleasant fragrance, resembling that of the vanilla-bean. When heated benzoic acid is evolved.

SUMATRA BENZOIN also comes in rectangular blocks, usually having its tears imbedded in a grayish-brown resinous mass, intermixed with foreign matter. Its odor is not so pronounced nor as agreeable as that of the Siam product. A variety of Sumatra benzoin, of unknown origin, known as *Penang benzoin* (Benjamin), or *Storax smelling benzoin* (Benjamin) has a much more agreeable odor than the Siam variety, comparing somewhat with storax. It frequently consists of large tears, agglutinated together by a grayish resin. The fragrance of the different kinds of benzoin is best compared by adding water to their tinctures. The best variety (Siam) yields a reddish tincture, that of the other grades being yellow-brown or brown.

Benzoin is firm, brittle, pulverizable, of an agreeable, balsamic odor when rubbed, and of a sweetish, balsamic, somewhat acrid taste. When pure it is wholly soluble in alcohol or ether. Upon exposure to heat, benzoin consumes with the discharge of a dense, irritating, white smoke, consisting of benzoic acid and a fragrant empyreumatic oil. In pulverizing benzoin, it irritates the lining membrane of the nostrils, causing sternutation. Water added to its alcoholic solution, precipitates it, forming a white liquid, which has been used as a cosmetic under the name of virgin's milk. Benzoin has a specific gravity of about 1.068. Official benzoin is thus described in the *U. S. P.:* "In lumps consisting of agglutinated, yellowish-brown tears, which are internally milk-white, or in the form of a reddish-brown mass, more or less mottled, from whitish tears imbedded in it. It is almost wholly soluble in 5 parts of moderately warm alcohol, and in solutions of fixed alkalies. When heated, it gives off fumes of benzoic acid. It has an agreeable, balsamic odor, and a slight, aromatic taste"—(*U. S. P.*).

That benzoin does not lose its properties by keeping is evident from the fact that the best benzoin we have ever seen was that recently recovered from a vessel wrecked in the East Indian trade two centuries ago.

Chemical Composition.—Benzoin belongs to the class of substances known as balsam-resins. It contains a small amount of volatile oil, about 75 per cent of amorphous resins, and about 18 per cent of benzoic acid. The white tears contain the latter in smaller quantities than the resiniform substance in which they are imbedded. Among the empyreumatic products resulting from the dry distillation of benzoin is a strongly fragrant, oily substance, designated *styrol.* *Cinnamic acid* ($C_9H_8O_2$) was found to be present in Siam and Penang benzoin (Kolbe and Lautemann, 1860). Sometimes only this acid is present, to the exclusion of benzoic acid. Aschoff found cinnamic acid alone in a sample of the Sumatra product, while in the amygdaloid Penang and Siam varieties, only the benzoic acid was present (1861). Flückiger, however, obtained cinnamic acid from the latter variety. Rump believed that both acids were not simultaneously present in any variety of benzoin, but that the cinnamic acid was present only in the Penang benzoin. The resins of benzoin, at least four in number, are all soluble in alcohol and caustic potash, but behave differently with other solvents, especially with ether. *Vanillin*, a product found mainly in vanilla, was obtained from Siam benzoin by Rump, in 1878. Benzoin was acted upon with caustic lime, the benzoic acid precipitated with chlorhydric acid, and the remaining liquid agitated with ether and evaporated, when a mixture of *vanillin* and benzoic acid remained.

Action, Medical Uses, and Dosage.—The effects of benzoin are much the same as those of benzoic acid, which is its most abundant constituent, modified by the resin and essential oil. It is never given in bulk or alone. It is eliminated chiefly by the mucous membranes.

Benzoin exerts a stimulating influence on the mucous tissues, and has been used to promote expectoration in chronic diseases of the air-passages. It is also stated to stimulate the sexual organs. It enters into the manufacture of elixir of paregoric, and constitutes the basis of Turlington's and many other balsams, which exert a salutary influence in healing *wounds;* the tincture is also employed to form a coating over the adhesive preparations so well known as *Court Plaster.* The fumes or vapor inhaled into the lungs, has been strongly recommended in *chronic pulmonary catarrhs*, and *old laryngeal inflammations.* The tincture is protective and stimulant in the early stage of *coryza* and as a dressing for *fresh wounds.* Benzoin is principally used to prepare benzoic acid, to improve the taste and odor of other medicines, and in perfumery. The dose, in preparations, may be equivalent to 10 to 40 grains.

Related Products.—PAGLIARI'S STYPTIC. A preparation called *Pagliari's Hæmostatic* or *Styptic*, has been used with some degree of success in *hemorrhages.* It is made by boiling together for 6 hours in a glazed earthen vessel, alum 1 pound, tincture of benzoin 8 ounces, water 10 pounds. As the water evaporates it must constantly be replaced with hot water, so as not to interrupt the ebullition, the resinous mass being stirred constantly. Then filter the fluid and keep in stoppered bottles. It is limpid, color of champagne, styptic in taste, and aromatic in odor. White resin has been successfully substituted for the benzoin. Every drop of this fluid poured into a glass containing human blood produces an instantaneous magma; and by increasing the proportion of the styptic to the quantity of the blood, a dense homogeneous, blackish mass results. It is said to be useful in all *arterial* and *venous hemorrhages.* In applying it, lint and bandages should be used to prevent the coagula which form from being removed from the mouths of the vessels; an application of them for 24 or 48 hours is sufficient.

BERBERIS.—BARBERRY.

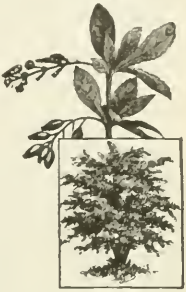
The bark of the root and the berries of *Berberis vulgaris*, Linné.

Nat. Ord.—Berberidaceæ.

Common Name: *Barberry.*

Illustration: Bentley and Trimen, *Med. Plants*, 16.

Fig. 46.



Berberis vulgaris.

Botanical Source.—Berberis vulgaris is an erect, deciduous shrub, from 3 to 8 feet high, with long, bending branches which are dotted with triple spines. The leaves are obovate-oval, simple, closely serrulate, alternate, petioled, about 2 inches long, one-third as wide, and terminated by soft bristles. In their primary state they are 3-parted and spiny. The flowers, which are small and yellow, are borne in clusters on lax, pendulous racemes. The petals are entire; the stamens irritable, springing violently against the stigma when touched. The fruit consists of bright red, very acid, oblong berries, clustered in bunches (L.—W.).

History.—This shrub, a native of Europe, and naturalized in Asia, is found in the New England States, on the mountains of Pennsylvania and Virginia, among rocks, and in hard, gravelly soils; occasionally it is found in the West on rich grounds. It flowers from April to June, and ripens its fruit in June. "It is frequently planted in gardens and prized for the beautiful bunches of red berries which hang after the leaves have fallen. The plant is generally a shrub from 2 to 8 feet high, although Loudon is authority that 'there are examples of trees 30 feet in height' and that 'they live for two or three centuries.' The wood contains a yellow, bitter coloring matter, and is sometimes used as a dye. The flowers are in pendulous racemes and appear in May or June. The leaves are obovate, bristly serrate, tapering at the base to a very short petiole. They are agreeably acid, resembling in this respect the leaves of the *Nat. Ord.*—Oxalidaceæ. The French name for barberry, *Epine vinette*, means literally an acid thorn. The fruit is a bright scarlet berry, and has an intensely, yet agreeably acid taste. It is said to make excellent preserves; was highly esteemed by the ancients, and probably would be now, if other fruits had not been cultivated to such a degree of excellence. The name berberys seems to have been first applied to this fruit by Averroes, an Arabic writer on medicine, who wrote in the Twelfth century" (*Berberidaceæ*, by C. G. and J. U. Lloyd, p. 5). Barberry bark, it is stated, has been used as an adulterant of pomegranite root bark.

Description.—This drug is the foliaceous bark of the barberry root, and occurs in thin sections, having an orange-yellow, smooth inner surface; externally it has a soft, yellow-gray periderm. It breaks with an abrupt fracture, exhibiting a vivid yellow interior. Its laminated structure permits of its being separated into layers. It has a bitter, non-astringent taste, but no odor. When chewed it imparts a yellow color to the saliva. In Europe the whole root is frequently employed. It is thick and tough, very much branched and hard. Externally it has a brown color; internally it is yellow, the color extending throughout the light, thick wood. Like its bark it is bitter and without odor.

Chemical Composition.—*Berberine* (see *Hydrastis*) is the active alkaloidal principle of this drug. It has also been found in Hydrastis, Podophylium, and other plants. According to Brande, the bark likewise contains gum, starch, fatty matter, chlorophyll, bitter yellow extractive (probably the above alkaloid in an impure condition), brown coloring matter, a resinous substance, lignin and water. Other alkaloids have also been found in this bark, viz.: *Oxyacanthine* ($C_{19}H_{21}NO_3$), also called *berbine* and *vinetine;* and *berbamine* ($C_{18}H_{19}NO_3$) (see *Berberis aquifolium*). A fourth alkaloid, in an amorphous condition, has also been obtained from it. A very little tannin is also said to be present, sufficient to give a green color with the ferric salts. The flowers contain sugar and an essential oil, while malic acid is present in the berries.

Action, Medical Uses, and Dosage.—"Berberis vulgaris, a native of Europe, is now quite common in this country, and for many years has been in domestic use as a medicine. A tea made from the bark is taken during the spring months as a blood purifier. A strong decoction is employed as an application to the *sores* which sometimes afflict children's lips, and in certain conditions of the system demanding tonic treatment, the infusion is a favorite remedy. The fluid extract is usually administered. It is readily prepared by those having the proper facilities, and can easily be made to represent the bark, fluid ounce to troy ounce. It is more satisfactory in its action than the alkaloid berberine" (Lloyd's *Berberidaceæ*). Berberis is a tonic and laxative. Formerly used extensively by practitioners in the New England States, in all cases where tonics are indicated, also in *jaundice*, and *chronic diarrhea* and *dysentery*. The berries form an agreeable acidulous draught, useful as a refrigerant in *fevers*, also beneficial in *dysentery*, *cholera infantum*, *diarrhœa*, etc. The bark is bitter and astringent, and has been used with advantage as a tonic. The bark of the root is the most active; a teaspoonful of the powder will act as a purgative. A decoction of the bark or berries, has been found of service as a wash in *aphthous sore mouth*, and in *chronic ophthalmia*.

Webster declares it of value in jaundice when there is no obstruction of the bile ducts, and in doses short of purgative stimulates the duodenal functions, relieving *intestinal dyspepsia*. Small doses are also palliative in *renal calculi*, and in soreness, burning, and other unpleasant sensations of the urinary tract.

Related Species.—"*Berberis Canadensis* is our only indigenous species of the Berberis proper. It very closely resembles the berberis vulgaris, but is a smaller shrub, with smaller leaves, smaller berries, and smaller and fewer flower racemes. Its locality is farther South than the introduced species, being a native of the Southern States. The acidity of the fruit and leaves and the yellow color of the wood are also observed in this species. It closely resembles the foregoing in medicinal properties. Doubtless it contains much the same principles, as the two species closely resemble each other and are used commonly for the same purpose" (*Berberidaceæ*, C. G. and J. U. Lloyd; see also *Berberis aquifolium*).

BERBERIS AQUIFOLIUM.—OREGON GRAPE.

The root of *Berberis aquifolium*, Pursh (*Mahonia aquifolium*, Paxton).

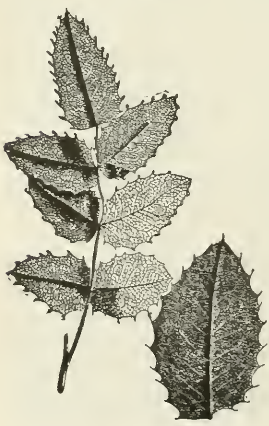
Nat. Ord.—Berberidaceæ.

COMMON NAMES: *Mountain grape*, *Oregon grape*.

ILLUSTRATIONS: Pursh, Vol. I, Plate iv; *Botanical Register*, 1425.

Botanical Source.—Berberis aquifolium is a shrub having stems about 6 feet high, erect, and of rapid growth. The leaves are alternate, and consist of 3 or 4 pairs of leaflets, and an odd one. They are evergreen, coriaceous, bright and shining upon the upper surface, and very ornamental; hence, the shrub is frequent in cultivation, often under the improper name "holly." The leaflets are smooth, ovate, from 2 to 3 inches long, and one-half as wide. They are acute, sessile, pinnately veined, and the margin is indented with from 15 to 30 repand spiny teeth. The lower pair of leaflets is from 1 to 2 inches distant from the base of the common petiole. The flowers are numerous, small, yellowish-green, and appear in early spring, borne in fascicled, terminal racemes. The calyx has 9 distinct sepals, colored like the petals and disposed in 2 rows, the outer of which consists of 3 sepals (bracts?). The petals are 6, distinct, orbicular, and in rows of 3 each. The stamens are also 6, and opposite the petals; they have irritable filaments, and extrorse anthers, opening, each by 2 little valves, hinged at the top. The fruit, which is known as "Oregon grape," is a cluster of purple berries, each containing an agreeably acid pulp, and from 3 to 9 seeds.

Fig. 47.



Leaves of Berberis aquifolium.

History.—This is a tall shrub, native of the western section of the United States. It grows from Colorado to the Pacific Ocean, and is especially abundant in Oregon and the northern part of California. Berberis aquifolium belongs to the section *Mahonia* of the genus *Berberis*, which section is considered by some botanists a distinct genus. The following synopsis of the difference between the two sub-genera is taken from "*Berberidaceæ*" (a pamphlet by C. G. and J. U. Lloyd, 1878):

> "The Berberis proper has simple leaves clustering in the axis of a simple or 3-parted spine. The petals have two glands on the inside of each, at the base. The filaments have no teeth. Berries 2 to 3-seeded.
>
> "Mahonia has oddly, pinnately, compound leaves, with no spine at the base, but with spiny-toothed leaflets. The petals are glandless. The stamens have a tooth on each side of the filament, near the top. Berries 3 to 9-seeded."

The section "Mahonia" is represented in the western United States by six species, viz.: *Berberis pinnata*, Lag., a tall shrub with the general appearance of *B. aquifolium*, distinguished from it by the leaflets, which are glaucous underneath, and the lower pair approximate to the base of the petiole; *Berberis repens*, Lind., a small creeping plant, with leaves often ternate, and leaflets nearly orbicular, and which has been much confounded, and frequently described as Berberis aquifolium. *Berberis nervosa*, Pursh, a small erect shrub, with leaves often longer than the stem—it appears to be more generally distributed than the other species. The chief characteristics of this species are, the leaflets are three-veined from an oblique base, the common petiole is jointed "like a bamboo stem," and the flowers are in slender racemes. The two other species, *B. Fendleri* and *B. Fremonti*, are of rare occurrence.

Berberis aquifolium and the other species long in use in domestic practice throughout the West, were brought into general notice a few years since by Parke, Davis & Co., of Detroit, who gave the remedy great conspicuity. Dr. Bundy, of Colusa, Cal., wrote many papers on its therapy; these were published in their journal, "*New Preparations*." From an examination of the drug, as thrown upon the market, we find the species are confounded, several of them being generally sold as *B. aquifolium*. The *B. nervosa* is more commonly met with in these sophistications, but we have likewise noticed *B. repens* in considerable amount. The confusion is, perhaps, unimportant from a therapeutical point, as all the Mahonias are bitter, and seem to contain *berberine* in nearly the same proportion (see *Related Species*).

Description.—The root of *Berberis aquifolium* is from ½ to 1 inch in diameter, often increasing to 2 and 3 inches at the base of the stem. It is woody, yellow throughout, and very hard. The bark is deep-yellow beneath and brown upon the surface. It is without odor and very bitter. The roots of the other species of Mahonia are smaller; the *B. pinnata* more nearly approaching the *B. aquifolium* in size; the *B. repens* is the smallest of any of the known species.

Chemical Composition.—*Berberis aquifolium* contains *berberine*, a yellow alkaloid (see *Hydrastis*), *berbamine*, and *oxyacanthine*, both white alkaloids, and phytosterin, gum and sugar. The flowers contain, in addition to the above alkaloids, volatile oil, and the berries contain malic acid.

The presence of *berberine* renders both root and bark bitter. The white alkaloid, *oxyacanthine* ($C_{19}H_{21}NO_3$, Rüdel), which forms soluble salts with most acids, is itself practically insoluble in water, soluble in hot alcohol and hot ether, and slightly so in cold alcohol and cold ether. It dissolves freely in fats and volatile oils, and in chloroform and benzol. It is alkaline, bitter, and in the presence of sunlight changes color, becoming yellowish. Iodic acid is reduced by it with the liberation of free iodine. With nitric acid a yellow color is produced, which, when heated, changes to purple. Cold sulphuric acid turns it brownish-red; on heating it changes to a vivid red, and finally a brown, color. With ferric chloride, in dilute solution of potassium ferricyanide, a blue color is produced with salts of oxyacanthine. Other names have been given this alkaloid to avoid confounding it with products of a species of thorn-apple, the *Cratægus Oxyacantha*. Thus *vinetine* was applied to it by Wacker, while Berzelius christened it *berbine*. *Berbamine* ($C_{18}H_{19}NO_3$) is a white alkaloid the salts of which dissolve slightly in solutions of

Chili saltpetre (nitrate of sodium). These salts strike a blue color with ferric chloride in a weak solution of ferricyanide of potassium. *Phytosterin* ($C_{26}H_{44}O.H_2O$) is a neutral body (found also in Calabar bean, *Physostigma venenosum*, Balfour), differing from *cholesterin*, which it closely resembles, by its solution in chloroform not having any affect on polarized light.

Action, Medical Uses, and Dosage.—This agent has justly been extolled as an alterative and tonic, and has been recommended in *syphilitic affections*, *salt-rheum*, *pityriasis*, *psoriasis*, and other *cutaneous affections*, as well as in maladies supposed to be due to some mal-condition of the blood. Excretion and secretion are promoted by it; digestion and assimilation improved; the lymphatic glandular system and the ductless glands are stimulated; and the renal secretions somewhat augmented. Thus it acts as a blood-maker, and is therefore a remedy to oppose depraved conditions of the body-fluids. As a tonic, it may be employed as a synonym of hydrastis, colombo, berberis, etc., possessing in addition its own peculiar virtues, in *dyspeptic conditions*, *chronic mucous maladies*, and in certain enfeebled conditions of the system, etc. Owing to its invigorating power over the gastric functions, it is a valuable remedy for *atonic dyspepsia*, and more particularly if associated with hepatic torpor, for which it is also an excellent remedy. A *cirrhotic liver*, associated with gastro-enteritis, has been benefited by it, and for *chronic constipation* it is a useful agent when combined with cascara sagrada. It is said to be effectual in *stomatitis*.

The great field for berberis aquifolium is in *constitutional syphilis* and its manifold complications and sequelæ. The disorders named above are more amenable to this drug when associated with a syphilitic taint than otherwise. If given early enough it will prevent tertiary phases, provided the patient has not been too thoroughly mercurialized. Its use must be prolonged in appreciable doses. It is especially adapted to long-standing cases of syphilis, the older the better, according to some of its advocates, and yet it is a remedy of much value all through the course of the disease. It is the remedy for that broken-down state so frequently following in the wake of that malady. The various eruptions give way to it, the gastric complications are subdued, and the mucous membranes are toned so that excessive secretions are restrained. The bone and periosteal, as well as the muscular, pains of syphilitics, are amenable to berberis. Its action is slow but sure, as it is also in severe muscular pains, with partial paralysis, due to spinal disease. Long standing *syphilitic phagadenæ* and *herpetic* and *eczematous states*, yield to it better than to most agents. It should not be forgotten in *syphilitic anemia*. Several stubborn cases of *psoriasis* (Ed. *E. M. J.*, p. 148, 1896) have been cured by it, and it is a valuable drug in *erysipelatous* and *chronic scrofulous affections*. While it has failed to cure *carcinoma*, as its introducer, Dr. J. H. Bundy, believed it would, it has, however, shown itself of value in the dyscrasiæ due to a *cancerous cachexia*.

Berberis aquifolium commends itself for study in certain pulmonic troubles, on account of its excellent results in controlling secretions of the mucous tract. Cases of *purulent bronchorrhœa*, pronounced incurable, have been cured by it, and Prof. Webster asserts that he has seen cases of *phthisis* recover, even where there were extensive cavities, under the use of this agent. The appetite improved, hectic subsided, expectoration became lessened, the cough milder and less frequent, and flesh and strength were augmented. The remedy should be long continued. Berberis is of some value in *leucorrhœa*, and particularly when a syphilitic taint exists. Owing to its remarkable power over mucous structures we would suggest its employment in *gastric* and *intestinal catarrh*. The principal uses of this drug have been developed by Dr. J. H. Bundy and Prof. Herbert T. Webster. The dose of berberis aquifolium should be relatively large. Small doses, as required of most of our important agents, do but little good.

The dose of the fluid extract is from 10 to 20 drops every 3 or 4 hours; of specific berberis aquifolium 5, 10 or 15 drops, every 3 or 4 hours.

Specific Indications and Uses.—Syphilitic dyscrasiæ, constitutional syphilis, with periosteal or muscular pains; chronic skin affections, with blood dyscrasiæ; profusely secreting, tumid mucous tissues; indigestion, with hepatic torpor; yellow skin, with marked weakness and emaciation.

Related Species.—"MAHONIA, the sub-genus of the genus berberis, is a fine, showy family of evergreen shrubs. The distinction between this sub-genus and the berberis proper, although very obvious, is not considered sufficient by authorities to entitle it to the rank of a distinct genus, hence the generic name is berberis, the same as the common barberry. The two species of the berberis proper, which grow in this country, are both deciduous shrubs, although there are several evergreen species found in the Old World. All the plants of the sub-genus, mahonia, are evergreen, and on this account they are often cultivated in yards and cemeteries, frequently under the improper name holly. There are four indigenous species found in the United States, all west of the Mississippi, and there are also a few other species in Mexico. Our native species are *B. nervosa*, *B. repens*, *B. pinnata*, and *B. aquifolium*. The two former are small plants, never over 2 feet high, and often only a few inches, while the other two are large shrubs from 3 to 6 feet high; hence by their height alone B. nervosa and B. repens can be distinguished from B. pinnata and B. aquifolium.

"*B. nervosa*, Pursh, is a little erect shrub, with leaves often longer than the stem. The leaves consist of 3 to 6 pairs of leaflets and an odd one. The main leaf stalk of each leaf is very conspicuously jointed at each pair of leaflets, as remarked by Dr. Lindley, 'like a bamboo stem.' The leaflets are ovate, lanceolate, acute or acuminate; triple veined from the oblique base, and have teeth, not repand, but serrate. The flowers are in erect racemes, which are more slender than those of any other species. The plate of *B. nervosa*, tab. 5, vol. 1, in Pursh's work, is spurious. The leaves are correct, as intended, but the flowers are of the *B. aquifolium*. Since the plate is made up of two species, and hence liable to confuse, Lindley proposed to remedy the matter by changing the name to *B. glumacea*, but the change was not received with favor by botanists, and the name *B. nervosa* is still applied to the plant.

"*B. repens*, Lindley.—A small shrub, procumbent, with short, erect branches. The leaves are often ternate, but generally of 5 or 7 leaflets. Leaflets are ovate, orbicular, acute, or the terminal leaflet obtuse; pinnately veined with repand teeth. Flowers in terminal fascicled racemes.

"*B. repens* and *B. nervosa* are both employed by the western miners as blood purifiers, and as an antiperiodic, the B. repens extensively. We have several letters from physicians in widely separated portions of the great West, enclosing leaves of these varieties for us to classify and examine, all saying the root is extensively used for the above purpose. It is made into infusions and decoctions. The acid berry of the Berberis repens, under the name 'mountain grape,' is made into confections and freely eaten. It acts as an antiscorbutic, and is of great benefit to persons long deprived of fruit.

"The following description was kindly furnished by Dr. C. L. Aylworth, of Montana State: 'The plant I enclose for description is called the Oregon grape. The fruit is eaten. It grows in medium or rich soil, among rocks or bushes, seldom in open ground. It is more plentiful upon the foot-hills of mountains, and along the banks of mountain streams, extending far down into the valleys. It does not grow in clusters, but I have seen it nearly cover the ground. It is common about all the small streams in this section of the Yellowstone valley, and about the headwaters of the Missouri river.'

"The root of the B. repens is a small, vine-like rhizome, resembling somewhat in appearance the Menispermum C., though not so fibrous. It is yellow throughout, woody, hard, and brittle. The bark, yellow within, is brown upon the surface and easily separated. The root and bark contain a large amount of berberine, which, together with other principles, is readily extracted by alcohol. It contains a principle in combination, precipitated by alkalies from aqueous solution. This, very likely, is identical with the white alkaloid of *Hydrastis canadensis*, or oxyacanthine.

"The medical profession at large is not acquainted with either of these plants under their proper names, although they may be upon the market for B. aquifolium.

"*B. pinnata*, Lagasca.—This is the only species that is liable to be confused with the medicinal species, B. aquifolium, as both are about the same size, and closely resemble each other. The leaflets are lanceolate, acuminate, and of a light-green color, glaucous on the under side. There are 2 to 6, seldom more, large teeth on each side of the leaflet, each ending in a slender spine. The specific character by which this species may always be distinguished from the B. aquifolium, is the position of the lower pair of leaflets. These leaflets are approximate to the base of the common petiole in the B. pinnata, and never at a distance from it, as they are in the aquifolium.

"*B. pinnata*, often called *Mahonia pinnata*, has not been used by the medical profession unless in local practice. It has been mistaken for B. aquifolium, which it nearly resembles, and from which its root can not be easily distinguished. Its berries are eaten by western settlers, and a tea from the root is used as a medicine" (from *Berberidaceæ*, by C. G. and J. U. Lloyd) (see also *Berberis* and *Berberis aquifolium*).

BETULA LENTA.—BLACK BIRCH.

The bark and leaves of the *Betula lenta*, Linné.

Nat. Ord.—Betulaceæ.

COMMON NAMES: *Cherry birch*, *Black birch*, *Sweet birch*, *Mahogany birch*, *Mountain mahogany*.

Botanical Source.—Black birch is a large tree growing from 50 to 70 feet in height, with a diameter of from 2 to 3 feet. Its leaves are cordate-ovate, acuminate, acutely and finely doubly serrate, hairy on the veins beneath, and on the petioles. The fertile aments are erect, elliptical, thick, and somewhat hairy; the sterile aments are from 2 to 3 inches long, longer than the fertile, and not so thick; the lobes of the veiny scales are nearly equal, obtuse, and diverging (W.—G.).

History.—This is a well known tree, growing in various parts of the United States. The trunk is invested with a dark-brown or reddish bark, which becomes rough in old trees, and has, together with the leaves, an aromatic flavor and taste, somewhat similar to wintergreen (*Gaultheria procumbens*, Linné); the wood is of a reddish color, strong, compact, and takes a fine polish; it is much used in cabinet work. The cambium is used in the spring by boys as a delicious morsel. The bark is the part used, and yields its properties to water. The leaves also possess active properties.

Chemical Composition.—The bark of this tree contains tannin. Both the bark and leaves yield a volatile oil, to which is due their peculiar and pleasant aroma. This oil is largely sold as oil of wintergreen, either wholly substituted for the latter, or mixed with it. Its identity with oil of gaultheria was pointed out by Prof. Procter, in 1843, who also called attention to the fact that it was a product—that it did not exist pre-formed in the bark as found on the market, but that it was the result of the mutual reaction between a neutral compound of the bark (somewhat similar to *amygdalin*) to which he applied the name *gaultherin*, and water. This oil was shown by Pettrigrew (1883) to be a very pure methyl salicylate (see *Oleum Gaultheriæ*).

Action, Medical Uses, and Dosage.—Gently stimulant, diaphoretic, and astringent. Used in warm infusion wherever a stimulating diaphoretic is required; also in *diarrhœa*, *dysentery*, *cholera infantum*, etc. In decoction or syrup it forms an excellent tonic to restore the tone of the bowels, after an attack of *dysentery*. Said to have been used in *gravel* and *female obstructions*. Oil of birch will produce a drunken stupor, vomiting, and death. It has been used in *gonorrhœa*, *rheumatism*, and *chronic skin diseases*. Dose, 5 to 10 drops.

Related Species.—*Betula alba*, Linné. *European birch*, *White birch*. Europe, America north of Pennsylvania, and North Asia. This tree yields a brown, warty bark from the limbs, and a whitish bark from the body of the tree, separating in paper-like layers. The bark has a bitter, astringent taste. Chemical manipulations of the latter have brought forth a camphoraceous substance known as *betulin* (*betula camphor*), having the composition $C_{36}H_{60}O_3$. It forms light crystalline flocculi, which when heated to 258° C. (496° F.), fuse as a tasteless mass, capable of being sublimed if carefully heated. It dissolves in hot alcohol, ether, alkaline solutions, and essential oils. By oxidation it splits up into two acids, *betulinic* ($C_{36}H_{54}O_{16}$) and *betulinamaric* ($C_{36}H_{52}O_{16}$) acids. A balsamic essential oil is obtained by distilling the young shoots and twigs, while the bark and wood, by destructive distillation, yield a tar-like body known as *dagget* or *birch-tar*. This, when distilled, yields *oleum rusci* (*ol. betulinum*; *ol. muscoritum*). This is an empyreumatic, brownish-red oil. This oil, birch-tar, and betula camphor (during dry distillation) give off an odor which resembles that of Russian leather, in the preparation of which the empyreumatic oil of birch is said to be largely employed. *Betulo-resinic acid* ($C_{36}H_{26}O_5$), is a powdery substance found on the leaves and young twigs of the tree. The white birch is a favorite remedy in northern Europe, where it is abundant. A spiritous beverage is prepared from the sap (through the intervention of yeast) by the peasants, and the sap itself is esteemed valuable in *cutaneous disorders*, *renal* and *genito-urinary affections*, *scurvy*, *gout*, *rheumatism*, and *intermittent febrile states*. An infusion of the leaves has been employed in *rheumatism*, *skin diseases*, *gout*, and *dropsy*, while for the rheumatic a bed of fresh leaves is prepared, and is said to occasion profuse diaphoresis. A pulpy mass of the bark, with gunpowder, is employed for *scabies*. The oil has been used internally in *gonorrhœa*, and externally in *skin eruptions*, especially those of an eczematous type.

Betula papyracea, Aiton. *Canoe birch*. Northern United States. The strong white bark of this species, which forms papyraceous layers, is used by the American Indians in covering their canoes.

BIDENS.—SPANISH NEEDLES.

The root and seeds of *Bidens bipinnata*, Linné.

Nat. Ord.—Compositæ.

COMMON NAME: *Spanish needles*.

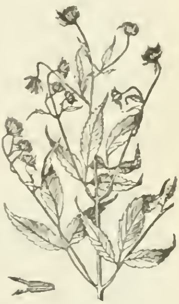
Botanical Source and History.—Bidens bipinnata is an annual plant, with a smooth, branched stem growing from 1 to 4 feet high. The leaves are bipinnately parted, nearly smooth and petioled; the leaflets ovate-lanceolate, pinnatifid, mostly wedge-shaped at the base; the heads of flowers on slender peduncles, each with 3 or 4 obscure, obovate, yellow rays; the outer involucre of linear scales are as long as the inner, and nearly as long as the short, pale, yellow rays; the achenia are long and slender, 4-grooved and angled, nearly smooth, 3 or 4-awned, and adhere to the dress and to the fleece of animals (G.—W.).

This is a common plant, growing in waste places on dry soils, flowering from July to September, and found from Connecticut to Pennsylvania and westward. The root and seeds of this and the related plants below mentioned are employed medicinally, and may be used in decoction, infusion, or tincture.

Action, Medical Uses, and Dosage.—Emmenagogue and expectorant; the seeds in powder or tincture have been successfully used in *amenorrhœa, dysmenorrhœa*, and some other *uterine derangements*; and an infusion of the root has proved beneficial in severe *cough*. *Hay asthma* has recently been treated with it. Infusion freely administered.

Related Species.—*Bidens frondosa*, Linné. *Common beggar-ticks.* Europe and United States. This plant has a smooth, branching, rather hairy stem, from 2 to 6 feet high. Leaves 3 to 5, divided; leaflets lanceolate, pointed, coarsely-toothed, mostly stalked, outer leafy involucre much longer than the head, ciliate below; rays none; flowers in clusters at the end of the branches, yellow; achenia wedge-obovate, 2-awned, the margins ciliate with upward bristles, except near the summit. This is a common, very troublesome weed, growing in moist, cultivated fields throughout the United States; the achenia, as in the other species, adhering by their retrorsely-barbed awns to clothes, etc. It flowers from July to September (G.—W.). Bidens frondosa in infusion has cured several cases of *croup*, even where they have been considered beyond aid. A strong infusion of the plant, sweetened with honey, was administered to the children, warm, in doses of a tablespoonful or more every 10 or 15 minutes, until it vomited. A quantity of mucous and membranous shreds were ejected, followed by immediate relief; the children passed into a sleep, from which they awakened perfectly well. In a few hours after the emetic operation of the warm infusion, it acted as a cathartic. The leaves from which the infusion was made, were, at the same time placed in a piece of flannel with some brandy added to them, and laid over the chest and throat. This plan is also beneficial in *colds, acute bronchial* and *laryngeal attacks* from exposure to cold, etc. An infusion of the seeds formed into a syrup with honey, is useful in *whooping-cough*. Dr. Scudder directs attention to its action on the heart and circulation, suggesting investigations in this line.

Fig. 48.



Bidens frondosa

Bidens connata, Willdenow (*Bidens tripartita*, Linné). *Cuckold's*, or *Swamp beggar-ticks*, has a smooth stem, 4-furrowed, with opposite branches, and grows from 1 to 3 feet high; the leaves are lanceolate, opposite, serrate, acuminate, slightly connate at the base; the lower ones are mostly trifid; the lateral divisions are united at the base, decurrent on the petiole; the scales of the outer involucre are longer than the head, leafy, mostly obtuse, scarcely ciliate; rays none; the achenia is narrowly wedge-form, 2, 3, or 4-awned, with downwardly-barbed margins; the flowers are terminal, solitary, consisting only of the tubular, yellow florets, surrounded by a leafy involucre. This is likewise a common weed found in wet grounds, rich fields, swamps, and ditches, from New England to Missouri. It flowers in August (G.—W.). Bidens connata has likewise been recommended in the above affections, also in *palpitation of the heart*, in which the infusion or decoction, drank freely through the day, has been found effectual.

Bidens cernua, Linné, *Bur-marigold*. Europe, Canada, and the United States. The leaves are subconnate, dentate, and lanceolate; the external scales are long as disk; the rays are pale yellow, few or none; the heads are *cernuous* (nodding). Swamps and ditches. For the uses of all three species, see also *Bidens bipinnata*.

BISMUTHI CITRAS (U. S. P.)—BISMUTH CITRATE.

FORMULA: $BiC_6H_5O_7$. MOLECULAR WEIGHT: 397.44.

SYNONYMS: *Bismuthum citricum, Citras bismuthicus, Citrate of bismuth.*

Preparation.—"Bismuth subnitrate, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; citric acid, seventy grammes (70 Gm.) [2 ozs. av., 205 grs.]; distilled water, a sufficient quantity. Boil the bismuth subnitrate and the citric acid with four hundred cubic centimeters (400 Cc.) [13 fl℥., 253 ♏.] of distilled water for about 15 minutes, or until a drop of the mixture yields a clear solution with ammonia water. Then add five thousand cubic centimeters (5000 Cc.) [a little more than 5½ quarts] of distilled water, allow the suspended matter to deposit, wash the precipitate, first by decantation, and afterward on a strainer, with distilled water, until the washings are tasteless, and dry the residue at a gentle heat"—(*U. S. P.*).

In this process decomposition ensues with the formation of anhydrous bismuth citrate, nitric acid, and water, the salt thus formed being almost insoluble in the two latter bodies. The reaction takes place according to the equation: $BiNO_3(OH)_2+C_6H_8O_7=BiC_6H_5O_7+NO_3H+2H_2O$, and is complete when ammonia water ceases to cause a precipitate of BiO(OH) in the supernatant liquid.

Description and Tests.—"A white, amorphous or micro-crystalline powder, odorless and tasteless, and permanent in the air. Insoluble in water or alcohol, but soluble in ammonia water, and in solutions of the citrates of the alkalies. When strongly heated, the salt chars, and, on ignition, leaves a more or less blackened residue having a yellow surface, and soluble in warm nitric acid. This solution, when dropped into water, occasions a white turbidity. A solution of the salt in ammonia water, when treated with hydrogen sulphide in excess, yields a black precipitate. If the filtrate from the latter be deprived by heat of the excess of hydrogen sulphide and cooled, a portion of it, boiled with lime-water, yields a white precipitate. If another portion of the cooled filtrate be mixed with an equal volume of concentrated sulphuric acid, and again cooled, no brown or brownish-black color should appear around a crystal of ferrous sulphate dropped into the liquid (limit of nitrate)"—(*U. S. P.*).

Pharmaceutical Uses.—Used chiefly in preparing *Bismuthi et Ammonii Citras.*

BISMUTHI ET AMMONII CITRAS (U. S. P.)—BISMUTH AND AMMONIUM CITRATE.

SYNONYMS: *Bismuthum citricum ammoniatum, Bismuthi ammonio-citras.*

Preparation.—"Bismuth citrate, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; ammonia water, distilled water, each, a sufficient quantity. Mix the bismuth citrate with two hundred cubic centimeters (200 Cc.) [6 fl℥, 367 ♏] of distilled water to a smooth paste, heat the mixture on a water-bath, and gradually add ammonia water, until the salt is dissolved, and the liquid is neutral or has only a faintly alkaline reaction. Then filter the solution, evaporate it on a water-bath to a syrupy consistence, and spread it upon plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in small, well-stoppered bottles, protected from light."

Description and Tests.—A somewhat variable salt, from the fact that no provision is made in the preceding process for the loss of ammonia, which necessarily occurs during the process of concentration. It is employed in the preparation of *Liquor Bismuth* (see *Liquor Bismuthi et Ammonii Citratis*), the original preparation of which was long kept secret by Mr. Schacht, of England. This salt, when dry, through loss of ammonia, becomes partially insoluble in water. If, however, a little ammonia water be cautiously added to the imperfect solution a clear liquid will result. The official description of this salt, and the tests for its purity are as follows:

"Small, shining, pearly or translucent scales, odorless, having a slightly acidulous and metallic taste, and becoming opaque on exposure to the air. Very soluble in water, and but sparingly soluble in alcohol. When strongly heated, the salt fuses, and finally leaves a more or less blackened residue, having a yellow surface, and soluble in warm nitric acid. This solution, when dropped into water, occasions a white turbidity. The aqueous solution of the salt is neutral or faintly alkaline to litmus paper. When boiled with potassium or sodium hydrate T.S., it evolves the vapor of ammonia, and when treated with hydrogen sulphide, it yields a black precipitate. If the filtrate from the latter be deprived by heat of the excess of hydrogen sulphide and cooled, a portion of it, boiled with lime water, yields a white precipitate. If another portion of the cooled filtrate be mixed with an equal volume of concentrated sulphuric acid, and again cooled, no brown or brownish-black color should appear around a crystal of ferrous sulphate dropped into the liquid (absence of nitrate)"—(*U. S. P.*).

Medical Uses.—(See *Liquor Bismuthi et Ammonii Citratis*).

BISMUTHI OXIDUM.—BISMUTH OXIDE.

FORMULA: Bi_2O_3. MOLECULAR WEIGHT: 465.68.

SYNONYMS: *Bismuthum oxydatum, Oxydum bismuthicum.*

Preparation.—"Take of subnitrate of bismuth 1 pound (av.), solution of soda 4 pints (Imp.). Mix and boil for five minutes; then, having allowed the mixture to cool and the oxide to subside, decant the supernatant liquid, wash the precipitate thoroughly with distilled water, and finally dry the oxide by the heat of a water-bath" (*Br. Ph.*).

In this process bismuth hydroxide is formed, which precipitates, leaving sodium nitrate in solution thus, $2(BiONO_3.H_2O)+2NaOH=2Bi(OH)_3+2NaNO_3$. When dried at ordinary temperatures, water is lost and bismuthyl-hydroxide (BiO.OH) remains, but when heated to 100° C. (212° F.) all the water is lost and the anhydrous oxide of bismuth is left.

Description.—Oxide of bismuth is a somewhat crystalline powder, of a dull yellow color, soluble, without effervescence, in mineral acids and in equal parts of nitric acid and water. It is not dissolved by water. Its solution in pure nitric acid should yield no precipitate, or at least should become but slightly turbid on the addition of silver nitrate solution. When heated to incipient redness it scarcely loses weight. At a high heat it melts to a brownish mass which, upon cooling, resumes a yellow color. Silver and lead oxides are among its impurities. They may be known by their appropriate tests.

Action, Medical Uses, and Dosage.—This agent resembles bismuth subnitrate in action, and may be used like it and in the same doses. It is, however, scarcely ever employed.

Related Compound.—BISMUTHI OXIDUM HYDRATUM (*N. F.*). *Hydrated oxide of bismuth. Formulary number*, 13: Bismuth subnitrate, three hundred grammes (300 Gm.) [10 ozs. av., 255 grs.); nitric acid (*U. S. P.*), five hundred grammes (500 Gm.) [1 lb. av. 1 oz., 278 grs.]; water of ammonia (*U. S. P.*), six hundred grammes (600 Gm.) [1 lb. av., 5 ozs., 72 grs.]; sodium bicarbonate, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; distilled water, a sufficient quantity.

Mix the bismuth subnitrate with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of distilled water in a quart flask, add four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of nitric acid, and promote the solution of the salt by agitation, and, if necessary, by a gentle heat. Pour the solution into six thousand cubic centimeters (6000 Cc.) [about 6⅓ qts.] of distilled water previously acidulated with fifty grammes (50 Gm.) [1 oz. av., 334 grs.] of nitric acid, and filter the liquid through absorbent cotton. Mix the water of ammonia with twelve thousand cubic centimeters (12,000 Cc.) [about 12⅔ qts.] of distilled water in a glazed vessel of double that capacity, and pour into it, slowly and with constant stirring, the bismuth solution. Let the mixture stand during four hours so that the precipitate may subside, then pour off the supernatant liquid, and wash the precipitate four times more by decantation with distilled water, the sodium bicarbonate being dissolved in the last wash water. Pour the precipitate upon a wetted muslin strainer, and wash it with distilled water, until the washings run off tasteless. Transfer the strainer to a warm place, so that the precipitate may dry. Then rub the latter into powder, and keep it in well-stoppered bottles.

Note.—"Hydrated oxide of bismuth is sometimes demanded in the form of a creamy mixture with water, under the name of *Cremor bismuthi* or *Cream of bismuth.* This may be prepared by triturating 20 parts of the oxide with 80 parts of water" (*Nat. Form.*).

BISMUTHI SUBCARBONAS (U. S. P.)—BISMUTH SUBCARBONATE.

SYNONYMS: *Bismuth carbonate, Oxycarbonate of bismuth, Subcarbonas bismuthicus, Bismuthi carbonas* (Br.), *Bismuthum subcarbonicum, Bismuthyl carbonate, Carbonate of bismuth.*

Preparation.—The British process for making this preparation is as follows: "Take of purified bismuth, in small pieces, 2 ounces (av.); nitric acid, 4 fluid ounces (Imp.); carbonate of ammonium, 6 ounces (av.); distilled water, a sufficiency. Mix the nitric acid with 3 ounces of distilled water and add the bismuth in successive portions. When effervescence has ceased apply for 10 minutes a temperature approaching that of ebullition, and afterwards decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to 2 fluid ounces, and add this, in small quantities at a time, to a cold filtered solution of the carbonate of ammonium in 2 pints of distilled water, continuously stirring during admixture. Collect the precipitate on a calico filter and wash it with distilled water until the washings pass tasteless. Remove now as much of the adhering water as can be separated from the precipitate by slight pressure with the hands, and finally dry the product at a temperature not exceeding 65.5° C. (150° F.)"—(*Br. Ph.*).

Most bismuth is contaminated with arsenic. The *U. S. P.* (1870) process was so constructed as to first purify the bismuth and the bismuth subcarbonate formed after purification. Such purification is not necessary in the British process, purified bismuth being used from the start. The *U. S. P.* (1870) process is as follows: "Take of bismuth, in pieces, 2 troy ounces; nitric acid, 8½ troy ounces; water of ammonia, 5 fluid ounces; carbonate of sodium, 10 troy ounces; distilled water, a sufficient quantity. Mix 4½ troy ounces of the nitric acid with 4 fluid ounces of distilled water in a capacious glass vessel, and having added the bismuth, set the whole aside for 24 hours. Dilute the resulting solution with 10 fluid ounces of distilled water, stir it thoroughly, and after 24 hours, filter through paper. To the filtered liquid, previously diluted with an equal measure of distilled water, slowly add the water of ammonia, constantly stirring. Transfer the whole to a strainer, and after the precipitate has been drained, wash it with 2 pints of distilled water, and drain it again. Then place the precipitate in a proper vessel, add the remainder of the nitric acid, and afterward 4 fluid ounces of distilled water, and set the solution aside. At the end of 24 hours filter through paper. Dissolve the carbonate of sodium in 12 fluid ounces of distilled water, with the aid of heat, and filter the solution through paper. To this, when cold, slowly add the solution of nitrate of bismuth, with constant stirring. Transfer the whole to a strainer, and after the precipitate has been drained, wash it with distilled water until the washings pass tasteless. Lastly, press, dry it on bibulous paper with a gentle heat, and rub it into powder"—(*U. S. P.*, 1870). Owing to the fact that this compound occurs in market in both dense and light form, the question often arises concerning the reason for this difference in condition. If the final precipitation be made with hot distilled water the precipitate is dense, a pound of it being easily placed in a pint bottle. If the water be very cold, the precipitate dries light and may require a 24-ounce bottle.

Ammonium carbonate is preferable to sodium carbonate as employed in the *U. S. P.* process, because of the difficulty in removing all traces of alkali from the subcarbonate by washing out with distilled water as directed by the *U. S. P.* (1870).

Description and Tests.—The formula ascribed to this compound by the *British Pharmacopœia* is $(Bi_2O_2CO_3)_3,H_2O$. No formula is given by the *U. S. P.*, which describes the salt as follows: "A white or pale yellowish-white powder of somewhat varying chemical composition, odorless and tasteless, and permanent in the air. Insoluble in water or alcohol, but completely soluble in nitric or hydrochloric acid, with copious effervescence. When heated to redness the salt loses water and carbon dioxide, and leaves from 87 to 91 per cent of a yellow residue which is soluble in nitric or hydrochloric acid, and blackened by hydrogen sulphide. If 3 Gm. of the salt be dissolved in just a sufficient quantity (about 4 Cc.) of warm nitric acid, and the solution poured into 100 Cc. of water, a white precipitate is produced. After filtering, and evaporating the filtrate on a water-bath to 30 Cc., again filtering and dividing this filtrate into portions of 5 Cc., these should respond to the following tests: On mixing one portion with an equal volume of diluted sulphuric acid, it should not become cloudy (absence of lead). If another portion be precipitated with a slight excess of ammonia water, the supernatant liquid should not exhibit a bluish tint (absence of copper). Other portions should not be affected by silver nitrate T.S. (absence of chloride), or barium nitrate T.S. (sulphate), nor yield, with hydrochloric acid, a precipitate which is insoluble in a slight excess of the latter (silver). If 1 Gm. of the salt be boiled with 10 Cc. of a mixture of equal parts of acetic acid and water, the solution cooled and filtered, and the filtrate freed from bismuth by hydrogen sulphide and again filtered, the last filtrate should leave no residue on evaporation (absence of alkalies and alkaline earths). On boiling 1 Gm. of the salt with 10 Cc. of potassium or sodium hydrate T.S., it should not evolve the odor of ammonia. If 1 Gm. of the salt be added to 10 Cc. of a mixture of equal parts of concentrated sulphuric acid and water, tinged slightly blue with indigo T.S., on heating, the bluish tint should not be discharged (absence of nitrate). If 1 Gm. of the salt be ignited in a porcelain crucible, the residue, when cold, dissolved in 5 Cc. of stannous chloride T.S. (see *List of Reagents*, Bettendorff's Test for Arsenic), and a small piece of pure tin-foil added, no dark coloration or precipitate should be produced within 15 minutes (limit of arsenic)" (*U. S. P.*).

Action, Medical Uses, and Dosage.—This agent was thought to be more soluble in the gastric fluids, and less liable to color the stools and to constipate, and was therefore introduced to take the place of subnitrate of bismuth. Its claims, however, have not led to its substitution for that agent. Dose, 10 to 40 grains in water.

BISMUTHI SUBNITRAS (U. S. P.)—BISMUTH SUBNITRATE.

FORMULA: $BiONO_3H_2O$ (approximate). MOLECULAR WEIGHT: 304.71.

SYNONYMS: *Bismuthum subnitricum, Subazotas bismuthicus, Subnitras bismuthicus, Magisterium bismuthi, Bismuthum hydrico-nitricum, Subnitrate of bismuth, White bismuth* (*Bismuthum album, Br. Ph.*, 1864) *Oxynitrate of bismuth*.

Preparation.—The British process is essentially as follows: Take of bismuth, in small pieces, and free from arsenic or other impurities, 2 ounces, add this gradually in successive portions, to a mixture of 4 fluid ounces (Imp. meas.) of nitric acid, and 3 fluid ounces (Imp. meas.) of distilled water. When effervescence has ceased apply nearly a boiling heat for 10 minutes, and decant the clear solution from any remaining undissolved particles of the metal. Evaporate this solution to 2 fluid ounces and pour it into ½ gallon of distilled water. Decant the supernatant liquid when precipitation has ceased, and agitate the sediment with ½ gallon (Imp. meas.) of distilled water. After 2 hours, again decant, and, placing the product on a calico filter, press it with the hands, and dry it at the temperature not higher than 65.5° C. (150° F.).

Most of the metal may be dissolved without the application of heat, and only when there is no more action in the cold, must heat be used. If the metal be not added gradually, the action will be very violent, and at the same time a basic salt will be formed, which can with difficulty be redissolved. Concentrated nitric acid attacks bismuth with great violence, a vast quantity of red nitrous gas is emitted, and the metal is converted into a white oxide. When the acid is diluted the action is less violent, and the oxide of bismuth is dissolved by the nitric acid remaining in the solution, which has not undergone decomposition. The solution is colorless, and, on cooling, lets fall white crystals of oblique rhomboidal prisms, generally attached to each other in the form of stars of the ternitrate of bismuth ($Bi[NO_3]_3+5H_2O$). When a large quantity of water is added to the clear solution, the ternitrate is decomposed, the subnitrate of bismuth precipitating in very fine white, silky, acicular crystals, while nitric acid remains in solution as represented in the following equation: $Bi(NO_3)_3+H_2O=BiO.NO_3+2NO_3H$.

Description and Tests.—The official description is as follows: "A heavy, white powder, of somewhat varying chemical composition, odorless and almost tasteless, and permanent in the air. Almost insoluble in water, and insoluble in alcohol; but readily soluble in nitric or hydrochloric acid. When heated to 120° C. (248° F.), the salt loses water (between 3 and 5 per cent of its weight); and when subsequently heated to redness, it evolves nitrous vapors, leaving from 79 to 82 per cent of its weight of a yellow residue which is soluble in nitric or hydrochloric acid, and blackened by hydrogen sulphide. When brought upon moistened blue litmus paper, the salt shows a slightly acid reaction. On dissolving 3 Gm. of the salt in 3 Cc. of warm nitric acid, no effervescence should occur (absence of carbonate), and no residue should be left (absence of insoluble foreign salts). If this solution be poured into 100 Cc. of water, a white precipitate is produced. If the filtrate, separated from this precipitate, be evaporated on a water-bath to 30 Cc., the liquid again filtered, and the new filtrate divided into portions of 5 Cc. each, these should respond to the tests for purity described under bismuthi subcarbonas. When further tested as described under bismuthi subcarbonas, the salt should be found free from alkalies and alkaline earths, and should give no reaction for ammonia. If 1 Gm. of the salt be heated, in a porcelain crucible, until nitrous vapors cease to be evolved, the residue, when cold, dissolved in 5 Cc. of stannous chloride T.S. (see *List of Reagents*, Bettendorff's Test for Arsenic), and a small piece of pure tin-foil added, no dark coloration or precipitate should be produced within 15 minutes (limit of arsenic)"—(*U. S. P.*).

Subnitrate of bismuth was also formerly known by the names *Trisnitrate of bismuth* and *White oxide of bismuth.* Hydrogen sulphide, or the sulphides, blacken it; light also darkens it when it contains a portion of silver, or when, in a moist state, it is placed in contact with paper or other organic substances. Under the blowpipe it gives out nitric acid, and is reduced to the yellow oxide of bismuth, and if the heat be continued globules of metallic bismuth are obtained.

If any lead be present, diluted sulphuric acid gives a white precipitate with the solution in nitric acid. Arsenic, which may sometimes be present, may be detected by Marsh's test, or Bettendorff's test (see above). This preparation of bismuth was formerly known by the name of *magistery of bismuth.* Thallium is also stated to be frequently present in this salt, and M. Roussin has found it adulterated with phosphate of calcium, in the proportion of 28 to 100. There is no excuse for any pharmacist dispensing an inferior grade now, as it can be obtained to stand the official test of all American manufacturers.

Action, Medical Uses, and Dosage.—The insoluble preparations of bismuth have a feebly metallic taste, and, owing to the formation, it is claimed, of a sulphide, give a blackish coat to the tongue. While the subnitrate acts chiefly as a local agent, it must be remembered it is also somewhat absorbed, for it has been detected in the blood, and in the urine and other secretions. Very likely some of its specific influence is so exerted. The peculiar pasty taste upon the tongue and in the mouth, even after it has been administered in sugar-coated pills so as not to touch the buccal tissues, would tend to prove that a portion of it at least is absorbed. The chief action, however, is its protective agency upon the mucous linings of the stomach and intestines, allaying irritation by distributing over the surface a practically insoluble coating of unirritating material, and, while not a true astringent, it somewhat restrains the secretions, and acts as an absorbent of excess of acids present. It does not coagulate the gastro-intestinal mucus.

It has been considered a tonic and antispasmodic, but it is doubtful whether it possesses any such properties, though it may relieve *spasm* dependent upon an irritable condition of the mucous lining membrane of the stomach and the alimentary canal, upon which, as before stated, it appears to exert a sedative influence. When given in overdoses, subnitrate of bismuth produces unpleasant symptoms, as pain in the stomach, sickness, emesis, derangement of the bowels, giddiness, insensibility, etc., for which the remedies are, albuminous and mucilaginous draughts, milk injections, and warm fomentations. Perhaps diluted nitric acid would also be useful. These effects are said not to be produced by pure bismuth subnitrate, but have been attributed to impurities present in the drug. It is probable that some such effects are possible from even the pure drug. The long-continued use of the subnitrate of bismuth occasions symptoms of scorbutus. After death from disorders in which bismuth has long been used, a bluish discoloration in portions of the small intestines has been observed, and, owing to the formation of sulphides, the colic and rectal membranes may be stained black. The granular, amorphous, hydrated oxide of bismuth must not be used in medicine; it may be known from the subnitrate by the crystalline character of the latter, under the microscope.

Subnitrate of bismuth has a very soothing influence upon irritated mucous surfaces, or when these are in a state of chronic inflammation, and on this account it is very useful in some forms of *dyspepsia*, *chronic gastritis*, *heartburn*, *gastrodynia*, *water-brash*, *colliquative diarrhœa*, etc. Also in obstinate *affections of the genito-urinary organs*, in *chronic urethritis*, in *muco-purulent leucorrhœa*, and in urethral injection in *gonorrhœa*.

Its field of action in *gastro-intestinal disorders* is in those states of morbid sensitiveness as evidenced by the elongated, pointed, and red tongue, especially reddened at the tip and edges, uneasy sensations with heat in the stomach, or excessive gastric acidity, with nausea, vomiting, or eructations of acid or acrid fluids, and irritative diarrhœa. While an excellent agent in these conditions many prefer for the same the *Liquor Bismuth*, or solution of ammonio-citrate of bismuth. It is especially applicable to mild forms of *gastritis* and *gastro-intestinal catarrh* of young children. Give from 1 to 3 grains every four hours. It is one of the most certain agents for the pain of *gastric ulcer*, though less valuable where the *gastralgia* is purely neuralgic. The case of simple ulcer may be known by the pain coming on at once upon the ingestion of food. It does not cure *cancer of the stomach*, but the following combination gives as much relief as any form of treatment: ℞ Bismuth subnitrate, grs. v to x; morphine sulphate, gr. $\frac{1}{16}$. Fiat, 1 powder. Sig. One powder every 6 hours (Locke). In *chronic diarrhœa* it has been found serviceable in doses of 5 to 20 grains every 1 or 2 hours; in the *diarrhœa* attending *typhus* and *phthisis*, 5 grains of the subnitrate combined with 3 grains, each, of magnesia and gum Arabic, has proved efficient—the dose to be repeated every 4 or 6 hours.

An excellent treatment for the *diarrhœa of phthisis* is that recommended by Prof. Locke (*Syllabus of Mat. Med.*, p. 375): ℞ Bismuth subnitrate, ʒj; cinnamon water, fl℥ij. Mix. Sig. Dose, 1 or 2 teaspoonfuls every 3 hours. A milk diet, with 5 or 6 grains of this salt, was very effectual in the *chronic diarrhœa* from exposure so common to military life in the late civil war. It is also very valuable in the *dysenterics of hot climates*. In a long-standing case of *chronic gastritis*, accompanied with a harassing cough, laryngitis, great debility, night-sweats, loss of appetite, looseness of the bowels, and a fiery red tongue, the following mixture proved very beneficial: Take of fluid extract of cubebs, 1 fluid ounce; mucilage of gum Arabic, 2 fluid ounces; lupulin, subnitrate of bismuth, each, 2 drachms and 40 grains; essence of lemon, 1 fluid drachm. Mix. The dose was a teaspoonful 3 or 4 times a day, shaking it thoroughly each time previous to its exhibition. Bismuth is sometimes added to pills as a tonic. The action of the gases in the bowels causes the bismuth salt to appear black in the stools.

Subnitrate of bismuth has been found useful as a drying local application in *ulcers* and diseased mucous tissues with profuse discharges, as in *leucorrhœa*, *catarrh*, *gonorrhœa*, *gleet*, etc.; it may be applied upon the affected parts direct, through a tube, by powder spray, or suspended in water and injected. *Aphthæ*, *nursing sore mouth*, and *painful ulcers of the mouth*, due to gastric disorders, are relieved by it locally applied. It is an excellent dressing for *abrasions*, but should not be used on large wounded areas. *Excoriations* and *intertigo*, when red and painful, should first be washed with a weak solution of borax or alum, well dried, and then dusted with bismuth subnitrate. *Bed sores*, *superficial burns*, *chapped hands* and *lips*, *cracked nipples*, *fissured anus*, *vaginal* and *rectal prolapse*, *eczema*, *variola*, and *irritable ulcers* are conditions in which it is of great usefulness, and it may do good service in *uterine ulceration*, with acrid, offensive discharges. *Ulcers of the septum nasi* may be first cauterized with a mild caustic and then dressed with bismuth subnitrate, ʒii, in glycerin, fl℥j. Prof. Locke recommends the following as a valuable cosmetic for *rough* and *pimpled skin:* ℞ Bismuth subnitrate, ʒij; glycerin, fl℥j; rose water, fl℥ii. Mix. Apply to face with a sponge after having washed well with Asepsin soap.

The dose of bismuth subnitrate is from 1 to 30 grains, 2 or 3 times a day, in powder, or mixed with mucilage. Where clearly indicated by the indications given, the small dose (2 to 4 grains) will usually be sufficient.

Specific Indications and Uses.—Elongated, red, pointed tongue, especially reddened at tip and edges; gastric uneasiness, with heat or pain from irritation; pyrosis, with acrid or acid eructations; intestinal irritation, with irritative diarrhœa; nausea and vomiting; gastric ulcer; morbid gastric sensitiveness. Locally, a soothing protective.

Bismuth and Its Salts.—BISMUTHUM. Symbol: Bi. Atomic weight: 208.9. Saxony furnishes the bulk of commercial bismuth. It is found there native in the metallic state, associated with nickel, cobalt, and argentiferous ores. Gold ore is sometimes associated with it, as in Colorado. Some bismuth is found in Australia, England, Texas, Connecticut, California, Mexico, Wyoming, Utah, Bolivia, France, and Hungary. Agricola (1520) was acquainted with bismuth, though Basil Valentine first differentiated it from other metals; but for a time afterwards it became confused with tin, antimony, lead, and zinc. Sometimes bismuth is found as an oxide, under the name of *Bismuth ochre*, but more frequently as sulphide (*Bismuth glance*) or telluride and sulphide ($[Bi_2Te_3]_2 + Bi_2S_3$), known in the latter case as the mineral *Tetradymit.* On account of its low melting point —268.3° C. (515° F.)—bismuth is readily obtained by melting the metal, by which means it is separated from its grosser impurities. When obtained from the sulphide, the latter is first roasted to change it into oxide, and then heated with charcoal to reduce it to the metallic condition. As obtained by these processes it is known as *Crude bismuth*, and, besides other metallic bodies, it contains varying amounts of arsenic, iron, and copper. For medicinal use it must first be purified—that is, freed from arsenic, sulphur, and selenium (see below). Bismuth is a lamellated, crystalline, grayish-white metal, brilliant in lustre and exhibiting a decidedly roseate or pinkish tinge. Its crystals are rhombohedral, appearing very much as if cubical; brittle, easily comminuted; have a density of 9.83; fuse at 268.3° C. (515° F.); boil near 1100° C. (2012° F.); and, in the presence of hydrogen, may be distilled. In the air it tarnishes somewhat. When at a red heat the vapor of water is decomposed by it, and in the air it burns with a faintly-blue flame, changing to a brown oxide, becoming yellow when cool. Nitric acid attacks it energetically, dissolving it with the escape of reddish vapor. Diluted sulphuric and concentrated hydrochloric acids act upon it with much greater difficulty. Combined with other metals bismuth lowers their melting-points. An alloy, for example, consisting of 15 parts Bi, 8 Pb, 4 Sn, 3 Cd, called Wood's metal, has a melting point of 60° C. (140° F.).

Bismuthum Purificatum.—"Take of bismuth, 10 ounces (av.); cyanide of potassium, ½ ounce (av.); sulphur, 80 grains; carbonate of potassium, recently ignited, and carbonate of sodium, recently ignited, of each a sufficiency. Melt the bismuth in a crucible; add the cyanide of potassium and sulphur, previously mixed; heat the whole to low redness for about 15 minutes, constantly stirring; remove the crucible from the fire and let it cool until the flux has solidified to a crust. Pierce two holes in the crust and pour the still fluid bismuth into another crucible. Remelt this partially purified bismuth with about 5 per cent of a mixture of equal parts of the dried carbonates of potassium and sodium, heating to bright redness and constantly stirring. Remove the crucible from the fire, cool, and pour out the bismuth into suitable molds" (*Br. Ph.*). For the *U. S. P.* (1870) method of purification see process for preparing bismuth subcarbonate.

Another method of purification, directed by some Pharmacopœias, consists in fusing the powdered bismuth with potassium nitrate for about 1 hour, and boiling out the impurities (arsenate, sulphate and selenate of potassium) with water.

Bismuthi Benzoas, *Bismuth benzoate.*—A compound containing 27 per cent of benzoic acid and introduced as a substitute for salicylate of bismuth by Vigier. It decomposes in the alimentary tract, liberating the acid. To prepare it dissolve bismuth nitrate (100 parts), in glycerin (20 parts) and distilled water (60 parts). To this solution add another, prepared by dissolving sodium benzoate (76 parts) in distilled water (200 parts), employing heat.

Bismuth-cerium Salicylate.—A powder of reddish-white color, soluble in neither water nor alcohol, introduced by Salaya, to be used in 5-grain doses in *enteritis, diarrhœa*, and *dysentery.*

Bismuthi Oxychloridum (BiOCl). *Bismuth oxychloride, Bismuthyl chloride.*—This salt is produced by pouring into a nitric acid solution of bismuth a sodium chloride solution. It constitutes a powder known as *pearl white*, and is sometimes sold for bismuth oxide. It is easily dissolved by acids, but refuses to dissolve in water. If heated in closed tubes, it first turns yellow and then melts.

Bismuthi Lactas, *Bismuth lactate.*—This is a powder, white, not soluble in alcohol, and but slowly dissolving in water. It may be made by boiling with excess of sodium hydroxide bismuth nitrate (10 parts), thoroughly washing the resulting oxide with water, and mixing it (moist) with lactic acid (9 parts). Allow the mixture to digest, and dry upon the water bath.

Bismuthi Phosphas, *Bismuth phosphate.*—This is a white powder prepared by dissolving in a little nitric acid 5 parts of bismuth subnitrate, and slowly pouring the solution into one of sodium phosphate (6 parts). Preferred by some to other bismuth salts on account of its greater insolubility. Dose, 1 to 5 grains.

Bismuthi Nitras ($Bi[NO_3]_3.5H_2O$), *Bismuth nitrate, Bismuthous nitrate.*—Also known as *Bismuth ternitrate, Bismuthum trisnitricum*, and *Normal bismuth nitrate.*—The manner of forming and purifying this salt has already been described. It forms large prismatic crystals without color, pronouncedly acid to the taste, and soluble in glycerin. Such a solution, when fresh, may be mixed in all amounts with water without precipitation (Dr. Balmano Squire). The salt is decomposed when added primarily to water, a basic nitrate resulting. The crystals melt in the crystal-water at near 80° C. (176° F); at 120° C. (248° F.), a portion of its acid is lost, while at 260° C. (500° F.) the whole of the acid is dissipated, an oxide (Bi_2O_3) being left. A *glycerite of bismuth nitrate* was proposed by Morehead, in 1877, in which bismuth nitrate (2 ounces), was to be dissolved without heat, in sufficient glycerin to produce 8 ounces of finished product. A perfect solution is produced, which may be diluted with water as desired.

Bismuthi Salicylas ($Bi[C_7H_5O_3]_3.Bi_2O_3$), *Bismuth salicylate.*—Duyk's process is to prepare bismuth oxide (Bi_2O_3), from pure bismuth subnitrate by means of ammonia water, and digesting the moist oxide with salicylic acid, wash the product with cold water, and dry the magma at a low temperature. It forms a tasteless, odorless, non-crystalline powder, having the color of cream. It is dissolved by acids, but not by water, alcohol, glycerin, or ether. This agent is not superior to the subnitrate, but has been used in *painful gastric affections* and *diarrhœa*. Extraordinary claims have been made for it in *typhoid fever*. Large doses of 10 to 30 grains, 3 times in 24 hours, are reputed efficient in *chronic catarrh of the stomach*. The nitro-salicylate of bismuth is reputed a heart stimulant.

Bismuthi Subiodidum (BiOI), *Bismuth subiodide, Bismuthyl iodide, Bismuth oxyiodide.*—This is a brown-red or bright-red powder, which may be crystalline or amorphous, according to the manner in which it is produced. When bismuth nitrate, suspended in water, is boiled with iodide of potassium, the crystalline salt is formed. It may be obtained amorphous by taking bismuth nitrate solution in such a proportion that the salt does not precipitate, and simply warming it with potassium iodide. This agent was introduced as an antiseptic to take the place of iodoform, and is used like bismuth subnitrate in *gastric disorders*, being particularly adapted to *chronic ulceration of the stomach* and other parts. Dose, 5 to 10 grains.

Bismuthi Subgallas ($C_6H_2[OH]_3.COOBi[OH]_2$), *Bismuth subgallate*, *Bismuth gallate*, *Bismuthi gallicum basicum.* Dermatol.—To prepare it dissolve in glacial acetic acid (30 parts), bismuth subnitrate (15 parts); then add 250 parts of water and filter the solution. Now prepare a second solution of gallic acid (5 parts), in water (250 parts), and while still warm add the warm solution, with constant stirring, to the filtrate first prepared. Decant the supernatant fluid, wash the precipitate until the presence of nitric acid is no longer detectable, and dry the product at a heat of 100° C. (212° F.). Dermatol is an impalpable powder, without odor, and having a saffron-yellow color. In the air it remains permanent, and the common solvents do not effect its solution. Though accredited with perfectly non-toxic properties, a peculiar intoxication is reported to have resulted from dermatol. It was introduced as an iodoform substitute, but is not so powerful a germicide as that agent. It is astringent, absorbent, sedative, and protective. Internally it has been given in doses of from 5 to 30 grains in *chronic diarrhœa* and *dysentery.* Locally it may be applied to parts after active inflammation has subsided, as in *wounds, ulcerations, abscesses, burns, herpes, eczemas*, etc.—in short, in the conditions for which iodoform is generally employed.

Bismuthi Valerianas ($Bi[C_5H_9O_2]_3$), *Bismuth valerianate*, *Valerianas bismuthicus.*—Valerianate of bismuth is a white, amorphous powder, with a strong valerian odor. It is made by dissolving pure metallic bismuth in nitric acid, saturating any excess of the acid with carbonate of sodium, and then adding a solution of valerianate of sodium to the bismuth solution as long as any precipitate continues. Collect the powder on a filter, wash and dry it. It has been highly recommended in *dyspepsia* with nervous irritability, *gastrodynia*, and in *neuralgic affections*, in doses of from ½ grain to 2 grains, repeated 3 or 4 times a day.

Bismuthi Tannas, *Bismuth tannate*, *Bismuthum tannicum*, *Tannas bismuthicus.*—Tannate of bismuth is prepared by treating 44 parts of crystallized nitrate of bismuth with water, at the same time adding a slight excess of caustic soda; collect the white hydrated precipitate (hydroxide of bismuth), on a filter, carefully wash it, and then triturate it in a mortar with 29 parts of pure tannic acid. Dilute the magma with water, throw it upon a filter, wash it, dry it in the air, or at a very moderate artificial heat, and reduce it to powder. It is a yellowish, insoluble powder, without taste, and may be given in pills, or suspended in a mucilaginous fluid. The dose is from 30 to 60 grains. It has proved remarkably efficient in the treatment of both *acute* and *chronic diarrhœa*; it was formerly used in *ophthalmia*, *leucorrhœa*, and *gonorrhœa*.

BOLDUS.—BOLDO.

The leaves of *Peumus Boldus*, Molina, (*Boldoa fragrans*, Gay).

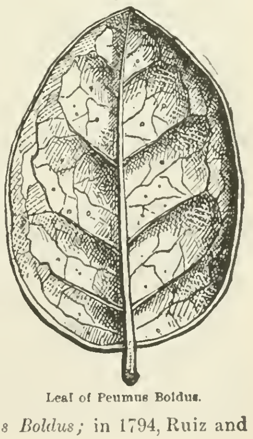
Nat. Ord.—Monimiaceæ.

Common Name: *Boldo* or *Boldu*.

Illustrations: *Bot. Reg.*, Plate 57; Bentley and Trimen, *Med. Plants*, 217.

Botanical Source. Peumus Boldus (*Bot. Reg.*, Plate 57, and Bentley and Trimen, *Med. Plants*, 217), is an evergreen, fragrant shrub, from 15 to 20 feet high, and native of the mountainous regions of Chili. The leaves are opposite, coriaceous, and on leaf-stalks about ¼ inch in length. The flowers are in loose, terminal, diœcious cymes of about 12 flowers each, on slender, pubescent pedicles. The petals are generally 7, strap-shape, and about ½ inch long, of a light-yellow color, and somewhat twisted. The male flower has numerous recurved stamens, with slender filaments, which are hairy at the base. The fruit is a small orange-green, 1-seeded drupe, which is aromatic and edible.

Fig. 49.



Leaf of Peumus Boldus.

Description.—The leaves (Fig. 49), as found in commerce, are thick, firm, of a light-green color, and covered with numerous glandular points on the upper surface. They are about 2 inches long, two-thirds as wide, and oval or elliptical in outline; have a rounded base, and a very obtuse apex. The edges are entire, and slightly recurved. The veins are pinnate, and prominent on the under side of the leaves. The odor of the leaves somewhat resembles that of wormseed, and the taste is nauseating and disagreeable.

History and Chemical Composition.—In 1782, Molina described this shrub, under the name *Peumus Boldus;* in 1794, Ruiz and

Pavon described the same plant under the name *Ruizia fragrans;* in 1809, Jussieu classed the plant under the name of *Boldoa fragrans;* finally, in 1869, M. H. Baillon presented a complete history of the plant under the name *Peumus Boldus*, which name it still retains. Boldo was introduced to the profession by Dujardin-Beaumetz and C. L. Verne, about 1872, and in the same year E. Bourgoin and C. Verne obtained from the leaves a volatile oil, and an alkaloid to which the name *boldine* or *boldina* was given. The plant also contains essential oil, citric acid, lime, sugar, gum, tannin, and a quantity of thick, black, aromatic substances, probably due to oxidation of the oil; these constituents have no medicinal virtues. *Boldoglucin*, a narcotic alkaloid, was isolated by Chapoteaut.

The plant attracted but little attention until 1875, when Prof. Bentley exhibited it before the Pharmaceutical Society of Great Britain, and Dr. Miller brought it before the Philadelphia Pharmaceutical meeting. After this, some little demand was created for it, and even at exorbitantly high prices, small amounts were sold in this country. At present the demand is limited, and the price is reasonable. The virtues of the drug, whatever they may be, are evidently derived from the essential oil and the alkaloid.

Boldine is obtained by extracting the leaves of the plant with alcohol, distilling the alcohol, and exhausting the residuum with acidulated water (acetic acid preferable), precipitating with ammonia, and purifying by solution in ether. It is a tedious operation to obtain the pure alkaloid. *Boldine* is crystallizable, soluble in alcohol, ether, chloroform, benzol, and benzin. The diluted acids dissolve it, from which solution ammonia, in slight excess, precipitates the alkaloid as an amorphous mass. It is sparingly soluble in water, to which it imparts a bitter taste, and gives an alkaline reaction. Nitric and sulphuric acids yield a red color when boldine is added to them. The best agent to extract the medicinal principles of the leaves is alcohol, and the addition of water to the menstruum, even in small amount, is objectionable.

Action, Medical Uses, and Dosage.—This agent is a stimulant to the circulatory organs and nervous structures. It is quieting and soothing, producing in full doses drowsiness. *Cerebral excitation* is said to be controlled by boldo and boldoglucin, refreshing sleep following Boldo was sent from Chili as an efficient agent in *hepatic diseases*, but its effect appears to be that of a gentle, diffusible stimulant, probably useful to a certain extent in *gastric debility*, *incipient dyspepsia*, *anemic conditions*, etc. It is of value in *painful digestion* with nervous irritability, and in *gastrodynia*. In these cases the alcoholic solution is undoubtedly the preferable one. A wine, elixir, and syrup have also been prepared, but they possess no advantages over the tincture, which may be used in doses of from 5 to 20 drops in some agreeable vehicle. One part of the leaves to 5 parts of alcohol, at 60 per cent, forms a deep-red, bordering a little on green, bitter tincture. Boldine may be given in doses of from 1 to 5 grains. The essential oil, in doses of from 3 to 5 drops, in capsules, has been recommended in *subacute inflammations* and *catarrh of the urinary passages;* but it certainly possesses no superior advantages over turpentine, copaiba, and other resinous balsams. A very moderate use of the oil will, in a few days, impart the strong odor of the leaves to the urine, which fluid will redden under the action of diluted sulphuric acid.

Specific Indications and Uses.—Gastric pain, nervousness, debility and jaundice.

Related Species.—*Atherosperma moschata*, Labillardière. *Sassafras tree.* Australia. All parts of this tree have a nutmeg-like odor. Tannin and a bitter alkaloidal body (*atherospermine*) have been obtained from the bark. The latter is an amorphous, white powder, sparingly soluble in ether, but dissolving freely in chloroform or alcohol. The bark is reputed antisyphilitic, antiscorbutic, and tonic. It renders difficult expectoration easy, reduces the pulse rate, and is sedative to an overacting, irregular heart. The Australian Bushmen employ a diet-drink prepared from it, in *rheumatism* and *secondary syphilis*. Graves personally found it of much value in *chronic bronchitis*.

Daphnandra repandula, F. von Mueller.—A toxic alkaloidal principle is derived from this plant, which is said to be, in some respects, the antagonist of strychnine. It is soluble in water. Muscular paralysis is produced by its local application. It has antiputrefactive qualities, and will deodorize tainted meats. The bark is rich in alkaloids which, when pure, are crystalline and colorless. It checks the growth of the yeast plant (*Torula cerevisiæ*). *Daphnandra micrantha*, Bentham (*Atherosperma micranthum*, Tul.), is identical with the foregoing in its action (*P. J. and Trans.*, 1887). It is intensely bitter, and is used as a tonic by the Australians.

BOLETUS.—WHITE AGARIC.

The fungus *Polyporus officinalis*, Fries (*Boletus laricis*, Jacquin; *Boletus purgans*, Persoon).

Nat. Ord.—Fungi.

COMMON NAMES: *White agaric*, *Larch agaric*, *Purging agaric*.

Description.—White agaric (*Agaricus albus*) is in masses varying from the size of an ordinary apple to that of a large nutmeg-melon; its shape somewhat resembles a horse's hoof; it is reddish-grey or yellowish externally, whitish internally, and of a spongy, friable consistence; hymenium concrete; substance of the hymenium consisting of subrotund pores, with their simple dissepiments; pileus corky-fleshy, ungulate, zoned, smooth; pores yellowish; it has a feeble odor, and a bitter, acrid, somewhat sweetish taste.

History.—The various medicinal substances, included under the elastic name *Agaric*, are obtained from various plants of the fungous tribe. These plants afford a great diversity of form and structure, being in their simplest character little articulated filaments composed of chains of cellules, as in the mildew of the rose bush, and in moldiness, *mucor;* again, they may present an even and imperforate surface, and another separated into plates or cells, in which the sporules are deposited. They absorb a great amount of oxygen with evolution of hydrogen and carbonic acid gas, and contain considerable proportions of nitrogen. They are destructive to nearly all organic matter upon which they grow. According to recent nomenclature, "the genus Boletus, as now constituted, includes only *fleshy* species, with a hymenium composed of *separable tubes*. Those species formerly included in Boletus (many of which have corky or woody tissues) and the hymenium of which is composed of pores *not separable* from the pileus or from each other, form the genus Polyporus."

The *Polyporus officinalis*, Fries (*Boletus laricis*, Jacquin), is procured from Asia, Corinthia, Russia, and Central America, where it is found growing upon the larch. It is collected in August and September, deprived of its outer covering, and then dried and bleached in the sun. It is exceedingly difficult to pulverize in a mortar, but may be readily powdered by grating through a sieve.

This substance is generally known in Eclectic medicine as *Boletus laricis*, hence that term is here retained though the fungus is properly a Polyporus, and should be known by that name.

Chemical Composition.—This fungus is remarkable for the great amount of *resinous* matter it contains, running as high as 79 per cent. Various resinous and crystallizable substances have been differentiated therefrom by several investigators. Jahns, in 1883, isolated *agaric acid* from the alcoholic extract of the fungus, for which he found the formula $C_{16}H_{30}O_5 + H_2O$. This formula and the bibasic nature of the acid was confirmed by Schmieder, in 1886, who made an exhaustive study of the chemistry of this fungus. Petroleum ether [boiling point, 45° C. (113° F.)], abstracted from the finely-powdered drug a fluorescent oil, from which crystals of *agaricol* ($C_{10}H_{16}O$) were separated, melting at 223° C. (430.7° F.). *Cholesterin* was obtained from the mother liquor; also two solid hydrocarbons, $C_{22}H_{46}$ and $C_{29}H_{54}$. The residue from the treatment with petroleum ether yielded to boiling water sugar, phosphoric, malic, and tannic acids. Boiling alcohol then abstracted 5 resins, the principal of which was a *red resin* ($C_{15}H_{24}O_4$), melting at 88° C. (190.4° F.), which is stated to be the actively purging principle of the drug. The fungus contains also a peculiar kind of cellulose, to the extent of 10 per cent, and ash, which mostly consists of the phosphates and carbonates of potassium and magnesium (Flückiger, *Pharmacognosie*, 1891). *Agaric acid* is official in the *German Pharmacopœia*, under the name of *Agaricinum*, and is described as a "white powder having a faint odor and taste, fusing at about 140° C. (284° F.) to a yellowish liquid; upon further heating evolving white fumes, and charring while giving off a caramel-like odor. It is little soluble in cold water; swells up in hot water and dissolves upon boiling, forming a frothing opalescent liquid, which faintly reddens litmus, and becomes strongly turbid upon cooling. Agaricin is soluble in 130 parts of cold, or 10 parts of hot alcohol; more easily soluble in warm acetic acid; very little soluble in ether; scarcely soluble in chloroform.

Caustic potash dissolves it, forming a liquid which, upon shaking, forms a heavy froth"—(*Ger. Pharm.*).

Action, Medical Uses, and Dosage.—*Polyporus officinalis* and the *P. pinicola* (see below), in doses of 3 or 4 grains of the powder, repeated every 3 or 4 hours, or of the concentrated tincture in doses of 5 drops, have both been found valuable in the cure of obstinate and long-standing *intermittents*, and other diseases common to malarial districts, as *obstinate bilious remittent fever*, *chronic diarrhœa*, *chronic dysentery*, *periodical neuralgia*, *nervous headache*, *ague cake*, and *increased flow of urine*. They have likewise proved useful in long-standing *jaundice*, and in the *chills* and *fever* common among consumptive patients.

The dust of the *Larch agaric* is irritating to mucous surfaces, causing tears when it enters the eyes, and sneezing, cough, and nausea, when the nostrils are exposed to it. It has been used in ½ drachm or drachm doses as a purgative; in larger doses as an emetic. Small doses, unless long continued, check *diarrhœa*, as well as *excessive broncho-pulmonary secretions;* hence the value of agaric and agaricin in *phthisis*. Boletus is also said to arrest the mammary secretion. In doses of 3 to 10 grains, gradually increasing to 60 grains in the course of the 24 hours, it has been found efficient in arresting the *nocturnal perspiration of consumptives*. For this purpose, however, *agaricin* (see below) is now preferred. Owing to its power over the sympathetic and spinal nervous system, certain cases of *epilepsy* and *chorea* have been controlled by it; and in *neuralgia* and *insanity* it has been found of value where nutrition was imperfect and the cerebral circulation feeble. As a remedy for *ague* it is adapted to those cases presenting alternate chills and flushes of heat, with heavy bearing-down pains in the back. The patient perspires freely at night and has a yellow-coated tongue, bitter taste, poor appetite, slight fever, and has for some time been experiencing a dull, languid feeling. Not only does it check phthisical night-sweats, but it also controls the rapid circulation and reduces the hectic fever. Externally, it has been used, together with the *Agaric of the oak* (*Polyporus fomentarius*, Fries) as a styptic, and is said to restrain not only venous, but arterial *hemorrhages*, without the use of ligatures; it does not appear, however, to possess any real styptic power, or to act otherwise than dry lint, sponge, or other soft applications. Prepared with nitre as for tinder, it has been used as a species of moxa.

AGARICIN (*agaric* or *agaricinic acid*) is irritant to the gastro-intestinal tract, occasioning, in doses of 5 to 15 grains, purging and vomiting. Upon the lower animals it depresses the nervous, respiratory, and circulatory systems. According to Riegel ⅙ grain of agaricin is equal, as an antihydrotic, to ¾ grain of atropine. In doses of 1/16 to ⅓ grain it has been remarkably effectual in *colliquative sweating*, especially in *phthisis*, where it also allays thirst and controls the cough and diarrhœa in some cases. Long continued use of it will produce looseness of the bowels.

Tincture of boletus, 1 to 5 drops; specific boletus, fraction of a drop to 5 drops; agaricin, 1/16 to ⅓ grain.

Specific Indications and Uses.—Ague, with alternate chills and flushes of heat, with heavy bearing-down pain in the back (Sp. Boletus, gtt. x to aqua, fl℥iv. Mix. Teaspoonful every 2 hours). Stimulant to nervous system, when nutrition is impaired and cerebral circulation feeble; colliquative sweats.

Related Fungi.—FUNGUS CHIRURGORUM, or *Surgeon's agaric*, known also as *Agaricus* (or *Boletus*), *chirurgorum*, and as *Spunk*, *Touchwood*, and *Tinder*, is the *Polyporus fomentarius*, Fries. A hoof-shaped, obliquely triangular, sessile fungus found on oak and beech trees in South and Central Europe, freed of its hard rind and hymenial, tubular spores, cut into slices, immersed in water, and afterward boiled in a weak, alkali solution, washed again, and finally beaten until soft and pliable. When cut into slices, beaten, soaked in a solution of nitre, and dried, it forms an inflammable substance known as *spunk*, *amadou*, or *German tinder*.

Surgeon's agaric is tasteless, practically odorless, and soft. It is in velvety, glossy, and cinnamon-colored flat pieces. It is exceedingly light, tough, porous, and elastic, and has long been valued to arrest local *hemorrhages*, small in amount. By insinuating it between the nail and the flesh, and securing it with adhesive strips, it is one of the best of substances for use in the treatment of *ingrown toe-nail*.

Polyporus igniarius, Fries, or *Agaric of the oak*, is a fungus found on oak, cherry, willow, plum, and other trees. When young it is soft, but gradually becomes hard and woody. In shape it somewhat resembles the *Polyporus officinalis;* its upper smooth surface is marked with dark circular ridges, and its under surface is very porous and of a yellowish-white color. It is tasteless and inodorous.

Polyporus pinicola grows upon the pine, birch, tamarac, fir, and similar trees. With absolute alcohol, the fresh fungus forms a dark-red, intensely bitter tincture

Amanita muscaria, Persoon (*Agaricus muscarius*, Linné). *Fungus muscarius* or *Fly agaric*.—This poisonous European fungus, which makes its growth in the autumn months, usually in pine woods, derives its common name from the fact that when infused in milk it is used for the purpose of destroying flies. The stem or stalk is white, thick, and tuberous or bulbous at the base, where there are also scales. It is about ¾ of an inch thick, and from 3 to 6 inches high. The cap or pileus, which is at first spherical, flattens out or becomes convex while growing, and when full grown is either flattish or depressed, and from 4 to 8 inches broad. The cap is usually scarlet or orange in color, though it has been found to vary to crimson, light-brown, greenish-yellow, or even white. Internally the fungus is yellowish. White, angular warts are scattered upon the surface of the pileus, and when moist these are sticky. The under surface has broad, white, lamellated gills, or hymenium. An acrid, burning taste and an unpleasant odor characterizes this species. Apoiger (1851) considered the toxic principle to be a crystallizable acid, while Letellier regarded *amanitin*, a brown, tasteless, non-crystalline glucosid, to be the active constituent. An alkaloid, *muscarine* ($C_5H_{15}NO_3$), was isolated, in 1869, by Schmiedeberg and Koppe, *choline* ($C_5H_{15}NO_2$), also a constituent of hops, beer, bile, brain, and herring brine, being associated with it. The latter body is probably identical with Harnack's (1876) *amanitine*. *Muscarine* (sometimes wrongly termed amanitine) is an exceedingly deliquescent, crystalline alkaloid, without color or odor; sparingly dissolved by chloroform, but not by ether. It unites with acids to produce deliquescent salts. It dissolves readily in water and alcohol. Kobert, in 1891, pointed out the existence in this fungus of another alkaloid, *pilzatropin*, this being the physiological opposite of muscarine. A. B. Griffith, in 1896, gave the name *amanitine* to the red, amorphous pigment of the fungus, insoluble in water, and soluble in chloroform and ether. Fly agaric once had a reputation as a remedy for *epilepsy*. *Chorea* is treated with it by homœopathists, and it was also used in *chronic skin affections*. That it possesses undoubted power over the nervous system seems well established, and its use is suggested in *spinal irritation* and *typhoid conditions* characterized by "tremor, restlessness, and desire to get out of bed" (Webster). Prof. Scudder (*Specific Medication*), who suggested a tincture of the fresh fungus prepared with strong alcohol, wrote: "Probably the best defined indication for this remedy is involuntary twitching of the muscles of the face, forehead, and even of the eyes, so that objects are not seen well because they seem to move; drawing of the tissues of the forehead and nose. Pressing pain in the occiput and an inclination to fall backward is also a very good indication." Tincture, gtt. j. to aqua fl℥iv. Dose, 1 teaspoonful. The principal use that has been made of this fungus is to control *colliquative night-sweats* from debilitating diseases, and profuse sweating during the daytime. The extract, in doses of 5 drops of a 1 per cent solution, has been employed. Muscarine may be used.

Muscarine is usually employed in the form of a sulphate or nitrate. It is an exceedingly energetic poison, and is antagonistic to atropine, and is sometimes used instead of eserine in poisoning by the latter. Profuse ptyalism, weeping, vomiting, depressed circulation, difficult breathing, muscular weakness, paralysis, and death are the effects of a toxic dose. Before death the pupils, which are minutely contracted, dilate. Tetanic contractions of the spleen, bladder, and intestines occur, and the latter finally relax, when violent peristaltic movements ensue. Muscarine is used in *colliquative sweats* and in *diabetes insipidus* in doses of $\frac{1}{30}$ to $\frac{1}{15}$ grain.

For the poisonous effects of Amanita species, see below (*Amanita phalloides*).

Amanita phalloides, Fries. *Death-cup* (see illustration, *Year Book of U.S. Agric. Dept.*, 1896, p. 144).—This is reputed the most toxic of all the fleshy fungi. It resembles in general shape the common mushroom, which, however, lacks the basal, cup-like appendage of the death-cup. It resembles also the *Amanita muscaria* (see above), from which it may be distinguished by the more brilliant coloring of the latter. This fungus grows in the medium elevations and low lands of nearly all parts of the United States and in Europe. The white stem when young is more or less pithy, but as the fungus grows it becomes somewhat fistulous. The young plant is entirely enclosed in a volva, which breaks circumcisally as the plant expands, leaving at the base, as a remnant of the volva, a cup-like appendage, which is characteristic. The cap, unless it should bear fragmentary remains of the volva, is usually smooth and satin-like, and when moist, viscid. It varies in color, and though most generally white or yellowish, it may be green, or if grown in deeply shaded situations, spotted. It has white gills and spores. The fungus varies in height from 3 to 5 inches. No bad taste gives warning of the dangerous character of this fungus, of which but a small portion may kill. A boy of 12 met death from a third of a middle-sized raw pileus. Out of 51 cases of poisoning by this plant, 75 per cent were fatal, and during the summer of 1893, 25 deaths in the United States alone, were attributed to species of amanita. A half day or more may elapse after swallowing the fungus before any discomfort is felt by the victim. Then follow severe intestinal pain, nausea and vomiting, and excessive diarrhœa of the rice-water type, symptoms closely resembling Asiatic cholera. These symptoms persisting, death may take place in from 2 to 4 days, consciousness being retained to the last.

That muscarine was the chief cause of the toxic symptoms has been maintained for several years. It has been observed, however, that in fatal cases the symptoms were different from those caused by muscarine alone, and that they were not antidoted by atropine, which is antagonistic to that alkaloid. Later investigations, in 1891, by Kobert, of Dorpat, seem to establish the fact that the chief toxic principle is a tox-albumin, not unlike abrin (see *Abrus precatorius*), and other poisonous albumins, such as have been found in rattlesnake and insect venom, barbadoes nut, castor-oil bean, etc. To this body the name *phallin* has been given. It is without odor and taste, and is easily coagulated by heat. Its death-dealing action appears to reside in its power to dissolve the red-blood discs, thereby allowing the blood serum to escape by way of the alimentary canal. Salt solution dissolves phallin, removing it from the fungus, but after having been swallowed there is no known antidote. For an excellent article, from which this note is compiled, see "*Some Common Poisonous Plants*" (illustrated), by V. K. Chesnut, in *Yearbook of U. S. Agric. Dept.*, 1896, p. 144.

Lycoperdon Bovista, Linné (*Lycoperdon giganteum*, Batsch; *Bovista giganteum*, Nees). *Giant puffball.*—Yellow or deep-brown, obconical or subglobular masses having a spongy interior. They sometimes attain a width of 2 feet. It furnished the *Fungus chirurgorum*, much used at one time as a local hæmostatic. Said to be anodyne and antiseptic, and to be a good application to *cancerous growths*, to allay pain and check bleeding. Porcher, from personal experience, declared Giant puffball to possess some narcotic power. A tincture has been used in *nervous affections* and the dry powder in *intertrigo*. The fumes from burning this common puffball are narcotic and anæsthetic, but no practical application of them has been made. In 1853, Dr. B. W. Richardson, acting upon the suggestion that bees were stupefied by the fumes of this fungus, experimented upon and narcotized and anæsthetized several animals, from one of which he painlessly removed a tumor. If carried too far the inhalation produced death, respiration being paralyzed. No congestion was produced. When death was not produced the animal slowly recovered, and even after the narcotism had passed off the perception of pain was for a time abolished. These effects have been attributed to carbonic oxide, the gas given off when the puffball is burned.

Elaphomyces granulatus, Fries (*Lycoperdon cervinum*, Linné; *Scleroderma granulatus*, Persoon.) *Hart's truffle*, *Puffball.*—Walnut-sized, warty, brown fungus, with a purple-brown interior. Stimulant.

Pachyma Cocos, Fries (*Lycoperdon solidum*, Gronovius). *Tuckahoe.*—A peculiar formation found upon fir-tree roots, believed to be an alteration of the same, produced by a fungus. It is found in the southern portion of the United States, where it is known as *tuckahoe*, or *Indian bread*. In China, where it also grows, it is called *fuh-ling*. It is a long or irregularly globose body, often weighing many pounds. It has a rugose, ashy-black surface, and a whitish, firm, but apparently spongy interior. It has a starchy appearance internally, and breaks into irregular fragments. It contains pectose, glucose, gum, cellulose, nitrogen, and salts.

Tuber cibarium, Sibthorp (*Lycoperdon Tuber*, Linné). *Truffle.*—An edible tuber growing beneath the surface of the ground. Walnut-sized, subglobose, warty, and blackish externally, with a fleshy, marbled (white and brown) interior.

BROMUM (U. S. P.)—BROMINE.

SYMBOL: Br. ATOMIC WEIGHT: 79.76.

Source, History and Preparation.—Bromine is one of the two known liquid elements. It was first obtained by Balard (1826), who prepared it from the mother-liquor left in the production of sea salt. It is always found in combination, never in a free condition. It exists in sea water principally in bromides of magnesium and sodium. The greater share of bromine, however, is prepared from the bittern of salt works. Formerly the supply came from the mineral springs of Europe and the Stassfurt potash-beds, but at the present time immense quantities are prepared from saline springs, along the Kanawha River, in West Virginia. Quite large quantities are prepared also in Pennsylvania, while in recent operations in Michigan bromine is said to be produced in as great amount as in West Virginia. Bromine may also be prepared from seaweeds. In sea water the bromides usually accompany chlorides. Balard pointed out its relationship to iodine and chlorine. Bromine is prepared for commerce by mixing sulphuric acid, manganese dioxide, and the evaporated mother-liquor of the salt springs in a stone retort and applying heat. By this process decomposition takes place, with the liberation of chlorine, which, in turn, decomposes the soluble bromides present, forming chlorides, allowing the bromine to distill over and condense. The greater portion of bromine is used in making the medicinal bromides and in photography. A portion, however, is used in the production of certain aniline dyes (which see).

Description and Tests.—Bromine in bulk appears almost black, but shaken so as to strike the sides of the bottle, it exhibits a ruby-red color. According to the *U. S. P.* it "should be kept in glass-stoppered bottles, in a cool place," and respond to the following description and tests:

"A heavy, dark brownish-red, mobile liquid, evolving, even at ordinary temperatures, a yellowish-red vapor, highly irritating to the eyes and lungs, and having a peculiar suffocating odor, resembling that of chlorine. Specific gravity: 2.990 at 15° C. (59° F.). Soluble in 30 parts of water at 15° C. (59° F.), and readily soluble in alcohol or ether (with gradual decomposition of these liquids);

also in carbon disulphide, and in chloroform, with a deep reddish-yellow color. On exposure to air or to heat it is completely volatilized. It destroys the color of solutions of litmus and indigo, and imparts a yellow color to solution of starch"—(*U. S. P.*).

At about —22° C. (—7.6° F.) it freezes, forming a leaden-colored crystalline solid. Its boiling point is near 62.7° C. (145° F.). From a saturated solution of bromine, at a little above 0° C. (32° F.), a crystalline body, having the formula $Br.(H_2O)_5$, is produced. Organic material is decomposed by bromine, while in dilution in water, like chlorine, though in a lesser degree, it acts as a decolorizer. A yellowish-brown color is imparted by it to starch. Aqueous solutions of bromine decompose in the sunlight, with the liberation of oxygen and the production of hydrobromic acid. This is true also of its solutions in alcohol and ether. Commercial bromine often contains, as impurities, carbon bromide, rendering its boiling point higher, and chlorine, which reduces its boiling point. Iodine is rarely present. Owing to its intensely poisonous vapor workmen, when handling bromine, always stand in a draught of air so that its fumes may be blown from them and keep near at hand a quantity of ammonia (which is its best antidote) to inhale in case it is breathed into the lungs. Bromine forms hydrogen salts, derivatives of hydrobromic acid, e. g., BrNa, called *bromides*, and oxy-salts of the type BrO_3Na, called *bromates*, or of the type BrONa, called *hypobromites*.

"If bromine be added to an excess of potassium or sodium hydrate T.S., it should combine to form a permanently clear liquid, without the separation of oily drops, or the development of an odor resembling that of chloroform (absence of bromoform or other organic bromine compounds). If an aqueous solution of bromine be shaken with a slight excess of reduced iron until it becomes nearly colorless, the filtered liquid, on the addition of a small amount of ferric chloride and of starch T.S., should not assume a blue color (absence of iodine). If 1 Cc. of a saturated aqueous solution of bromine be diluted with 9 Cc. of water, then mixed with 3 Cc. of ammonium carbonate T.S., and 5 Cc. of decinormal silver nitrate V.S., and the whole actively shaken, the filtered liquid, when supersaturated with nitric acid, should not become more than opalescent, nor separate a flocculent precipitate within 3 minutes (absence of more than 3 per cent of chlorine)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Bromine, in vapor, is an irrespirable irritant poison, and, locally applied, is corrosive. An atmosphere impregnated with the fumes occasions excessive secretions and discharges from the throat, nose, and eyes, associated with hoarseness, cough, and difficulty in breathing. Vomiting, intense pain, and diarrhœa, followed by death, are the toxic symptoms. As with iodine and chlorine paralysis of the brain centers is produced; and respiratory paralysis is the direct cause of death. The gastric and intestinal mucous membranes are found corroded and softened. The element, in medicinal doses, is a cerebral sedative, and allays sensory irritability. Faucial anæsthesia is also among its effects. It depresses the sexual functions and somewhat obtunds the sensibility of the genito-urinary passages. Applied to the skin, a weak solution (1 to 8) relieves pain; applied full strength, it is a penetrating cauterant, and may cause gangrenous ulcers. In internal poisoning by bromine the stomach should be washed out and a brisk purgative be administered in alkaline water; in inhalation, alkaline vapors from a steam-atomizer, or better, the cautious inhalation of ammonia, is recommended.

The earliest use of bromine was in those constitutional disorders for which iodine was employed, and in which that drug has now almost entirely superseded bromine. It is, however, still used, in minute doses, in *strumous enlargements* of the lymphatic glandular structures. Here it is given in 1 or 2-grain doses of the 6 x trituration, 3 or 4 times a day. As an inhalation it is sometimes employed in *diphtheria* and *croup* (♏ x to aqua fl℥ij). Bromine is an excellent deodorant and disinfectant. A dilute solution should be employed. During the war of secession it was largely employed as a remedy for *hospital gangrene*. The method of Goldsmith, who introduced this procedure, was to apply the pure bromine upon a lint or cotton swab to the cleansed gangrenous parts, subsequently covering with lint moistened with a weak aqueous solution of bromine, and bandaging the whole with oiled silk. This dressing was followed in a few hours by a poultice, which separated the eschar, and, by healthy granulation, the wound quickly healed. It has since been employed locally to *diphtheritic membranes*, using equal parts of bromine and potassium bromide ($\frac{1}{2}$ to 3 grains) in water (fl℥vj). The affected parts are penciled with the solution. The results, however, have been none too satisfactory, and the method is open to serious objections if the larynx be involved, or if broncho-pulmonary disorders exist. *Cancer*, especially of the womb, has been treated with an alcoholic solution of bromine (1 in 2 or 3 parts). *Chancres* and *chancroids* have been destroyed with it, and a sweet-oil solution (♏ x to fl℥j) has been employed as a sedative application for *chancroid*, and for the eruption caused by *Rhus Toxicodendron*. Dose, 1 or 2 grains of the 6 x trituration 3 or 4 times a day.

Specific Indications and Uses.—Locally, to hospital gangrene; by inhalation, in croup (10 drops to 1 fluid ounce of hot water).

Bromine Compounds.—BROMOL. *Tribromophenol.* Formula: $C_6H_2Br_3OH$. Molecular Weight: 330.06. This compound must not be confounded with *bromal* (see below). When an aqueous solution of carbolic acid (phenol) is acted upon by bromine, bromol results. It forms a white crystalline compound, having an unpleasant, bromine-like odor; to the taste it is sweetish and astringent. It refuses to dissolve in water, but is readily dissolved by alcohol, chloroform, ether, glycerin, and oils. Bromol fuses at 95° C. (203° F.). Bromol is considered an efficient non-toxic antiseptic. Locally, in glycerin solution (1 in 25), it has been employed in *diphtheria*, in *gangrene*, and upon *tuberculous ulcerations;* internally, as an intestinal antiseptic in *typhus fever* and in *cholera infantum*. The dose is from $\frac{1}{12}$ to $\frac{1}{3}$ grain.

BROMI CHLORIDUM, *Chloride of bromine.*—Under this name a mixture of chlorine and bromine has been used in medicine. It is probably not, as its name would indicate, a true or definite chemical compound. It is prepared by mixing bromine, 1 part, with cold water, 60 parts, and passing into the mixture a stream of chlorine gas, until the bromine disappears and a dark red solution, having a powerfully irritating odor, results. This volatile liquor is soluble in water, and is intensely caustic. It was used by Landolfi as the chief ingredient of a paste employed for the destruction of *malignant growths*, having been, at one time, quite popular in Europe for the treatment of *cancer*. The remedy soon fell into disrepute.

BROMAL.—Formula: C_2HBr_3O. Molecular Weight: 280.18. Chemically, this compound is analogous to chloral (C_2HCl_3O). It is a colorless, oily fluid, having a distinctive, pungent odor; is a conjunctival irritant, and to the taste is sharp and burning. It is prepared by adding bromine slowly to refrigerated absolute alcohol, and, after several hours' (15 to 24) contact, distilling the mixture, when volatile matter, including bromine, first passes over; subsequently [between 170° to 180° C. (341.6° to 356° F.)] bromal distills and is condensed in an oily condition, congealing at a reduced temperature—20° C. (—4° F.). In contact with water large crystals of *bromal hydrate* are produced; with alcohol a crystalline *alcoholate* results. Mere exposure to a moist atmosphere results in the formation of a white mass of crystals of the hydrate of bromal ($C_2HBr_3O.H_2O$). The *hydrate* melts at 53.5° C. (128.3° F.); the *alcoholate* at 44° C. (111.2° F.). Bromoform is produced from bromal and bromal hydrate through the decomposing action of caustic alkalies, the reaction being similar to that by which chloroform is obtained from chloral or its hydrate. The hydrate is soluble in water; the alcoholate but slightly so. Heat decomposes the latter at 100° C. (212° F.). Bromal may be distilled unchanged, and has a boiling point of 172° to 173° C. (341.6° to 343.4° F.).

Bromal hydrate, the form employed chiefly in medicine, is a powerful irritant. Inflammatory conditions, with cellular infiltration, result from its application to the integument as an ointment. It is a pain-relieving and sleep-producing drug, by some thought to be superior to chloral. It must be employed largely diluted, and, even in dilution, may occasion a sensation of heat in the fauces, diarrhœa, and vomiting. In both warm and cold-blooded animals, according to Stinauer, who investigated it physiologically, it produced moderate sleep, and almost perfect anæsthesia, after previously producing marked restlessness. Dyspnœa and finally death from convulsions ensued, and the ventricles of the heart were found relaxed, or tetanically contracted according to dose—large or small. It has been given in *epilepsy* with varied results. The dose is from 2 to 5 grains, largely diluted.

BROMAMIDE ($C_6H_2Br_3NH.HBr$).—A compound of the anilide group, containing bromine to the extent of about 75 per cent, as calculated from the formula. It occurs in crystalline needles, without taste, odor or color. It is insoluble in water and benzin, sparingly dissolved by alcohol, but freely soluble in ether, chloroform, and fixed oils. It fuses at 117.2° C. (243° F.), and heated to 154.4° C. (310° F.) volatilizes. Owing to its reputed antipyretic properties, it has been used with asserted favorable results in *typhoid fever*, *rheumatic fever*, and *articular rheumatism*, acute and chronic. *Neuralgia*, in its many forms, has been treated with it. It has also been employed with asserted benefit in *nephritic dropsies*. The dose for adults, from 5 to 10 grains; for children, 1 to 5 grains; preferably in capsule, water, or emulsion.

BROMOFORM, *Tribromomethane.*—Formula: $CHBr_3$. Molecular Weight: 252.25. This liquid is the analogue of chloroform. It is produced when bromine acts upon alcohol in contact with alkaline earths or the caustic alkalies. It is largely made by saturating a solution of calcium hydroxide with bromine, adding alcohol, and distilling the mixture. According to Denigès' method, by which nearly all of the commercial article is now produced, sodium hypobromite is made to act upon acetone, as follows: To a solution of caustic soda bromine is added, the result being sodium bromide and sodium hypobromite. The mixture is allowed to come into contact with acetone, reaction ensues, resulting in the formation of bromoform and sodium acetate, principally. Bromoform is a sweet, limpid, colorless liquid, emitting an aromatic fragrance. It is dissolved to a slight extent by water, but freely by alcohol and ether. Its density at 0° C. (32° F.) is 2.83. It boils at 147° to 151° C. (296.6° to 303.8° F.) and becomes solid at 2.5° C. (36° F.). Sunlight decomposes bromoform. In administering this drug only that which is colorless and free from *acids* should be employed. Bromoform was suggested as a pleasant anesthetic in 1849. Van Horoch, in 1883, investigated and used it as an anesthetic on man. Its anaesthetic properties are very similar to those of chloroform, though it is slower in action, and, unlike the latter, produces no pre-narcotic excitement. The Schneiderian and conjunctival membranes are sometimes irritated by it. Collapse, coma, and cyanotic countenance are the effects of its toxic action, and bromine is eliminated by the urine. Bromoform is antiseptic, analgesic, and antispasmodic. It is for its action in *whooping-cough* that it is most valued. Though not perfectly miscible with water, it may be prescribed in that liquid; or, for children especially, syrup of acacia, or alcohol, may be employed as a vehicle. The dose ranges from 1 to 5 drops, 3 times a day.

BRYONIA (U. S. P.)—BRYONIA.

The root of *Bryonia dioica*, Jacquin (*Bryonia alba*, Hudson), and *Bryonia alba*, Linné.

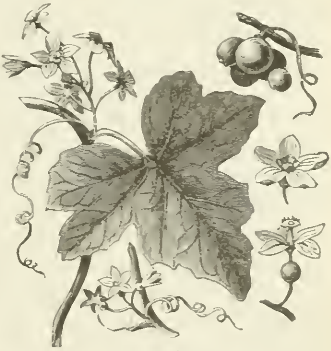
Nat. Ord.—Cucurbitaceæ.

COMMON NAMES: *Bryony, Snakeweed, Devil's turnip, Bastard turnip, Parsnip turnip.*

ILLUSTRATION: Woodville's *Med. Bot.*, Plate 187.

Botanical Source.—The species used in medicine are *Bryonia dioica* and *Bryonia alba*. The genus to which they belong is a family of herbaceous vines, climbing by means of tendrils. The species, of which there are about 50, are found in most parts of the Old World. They are distinguished from the allied plants of the natural order Cucurbitaceæ, by having the flowers monœcious, or occasionally diœcious, the 5 stamens united into 3 bundles, and the fruit globular and berry-like.

Fig. 50.



Bryonia dioica.

Bryonia dioica belongs to the section of the genus Bryonia, with palmately lobed leaves. It is common among the hedges and in the borders of woods in Europe, especially in the calcareous soil of some parts of England, where it is quite ornamental. The stem, which is a rough annual, climbs to the height of several feet above hedges and undershrubs; the leaves are cordate and 5-lobed, the terminal lobe being longer than the others, and dissimilar. The flowers are of a light, greenish-white color, with darker green veins; they are perfectly diœcious in the young plants, although both sexes are often found on older individuals. The fruit is a bright scarlet berry (*red bryonia*), with several flat seeds.

Bryonia alba is a closely related plant, found in Central Europe, Sweden, and Denmark. It has white flowers, regularly lobed leaves, and black berries (*Black bryonia*). These two species of bryonia must not be confounded with the black bryony (*Tamus communis*), a European plant of the natural order Dioscoreaceæ.

History and Description.—Bryonia has been used in medicine throughout sections of Europe for a great many years, and occupied a conspicuous place in the *London Dispensatory*, published in 1653. It is vulgarly known as *snakeweed, devil's turnip, parsnip turnip*, and *bastard turnip*. The root, the part employed, is from 2 to 4 inches in diameter, and about 2 feet in length, although occasionally larger. It is fleshy, and when wounded, yields a milky juice. Internally it resembles the root of Phytolacca decandra, maintaining the similarity when sliced and dried.

As found in our market, bryonia is in slices, often worm-eaten, or even decayed, and totally unfit for use. It is said that the purgative principle (*Bryonin*), is stable, but, undoubtedly, even though this be the case, it can not withstand the attacks of time and the ravages of insects, for tinctures prepared from inferior specimens will not give satisfaction. The Pharmacopœia describes the drug from both species as follows: "In transverse sections about 5 Cm. (2 inches) in diameter, the bark gray-brown, rough, thin, the central portion whitish or grayish, with numerous small, projecting wood-bundles arranged in circles and radiating lines; fracture short; inodorous; taste disagreeably bitter"—(*U. S. P.*).

Chemical Composition.—In 1858, G. F. Walz published an article upon the chemical composition of *Bryonia alba* (*Archiv. der Pharm.*, cxlvi), the result being the identification of two white, crystallizable bodies, *bryonin* and *bryonitin*. The latter substance, however, was, in 1862, admitted by Walz not to be an individual body, but merely a mixture of a crystalline, fatty acid, and some saponifiable fat (*Amer. Jour. Pharm.*, 1862). To obtain *bryonin* from the root, an alcholic extract is made of the latter, and the resulting product, after evaporation, is treated with water. After extraction of the aqueous extract with ether, *bryonin*, with impurities, remains in the residuum, and may be obtained by dissolving the residuum in water, precipitating the coloring matter with acetate of lead, the excess of which must be removed with sulphide of hydrogen; after filtration, neutralize the filtrate with carbonate of sodium; then precipitate with tannic acid, dissolve the precipitate in alcohol, digest with calcium hydroxide, filter, digest with animal charcoal, again filter, and evaporate. *Bryonin* is a colorless powder, very bitter, soluble in water and alcohol, and insoluble in ether and in chloroform; when boiled with diluted sulphuric acid it assumes a bluish tint, splits into sugar and two bodies named by Walz, *bryoretin* (soluble in ether), and *hydrobryotin* (insoluble in ether). Walz's analysis would point, for *bryonin*, to the formula $C_{25}H_{42}O_{10}$, while Masson, in 1893, arrived at the formula $C_{34}H_{48}O_9$. Starch, sugar, gum, wax, fatty constituents, albumen, cellulose, and salts, are also present in the root.

Action, Medical Uses, and Dosage.—The fresh root of bryonia is extremely irritating, occasioning blisters when bruised and kept in contact with the skin, and causing serious gastro-intestinal inflammation when taken internally. A profuse and uncontrollable diarrhœa, vomiting, vertigo, reduction of temperature, dilatation of the pupils, cold perspiration, extremely small pulse, colic, collapse, and death have resulted from its use. Its influence on the nervous system is marked. A similar result follows the administration of large doses of the dried root. An infusion of galls is said to antidote it. This root appears to have been well known to the ancients, and was used in various maladies. It has likewise been employed in more recent times in *convulsions* due to the presence of *worms* in the intestines, as a cathartic in *dropsy*, and in cases of *chronic inflammations*, attended with glandular enlargements, or serous effusions. It is chiefly used at the present day in small doses, as a remedy in *acute* and *chronic serous maladies*, in *glandular enlargements*, in *scarlatina* to lessen the tendency to aural complications that may terminate in otorrhœa and deafness, in *chronic orchitis*, in *chronic rheumatic affections*, *pleuritic* and *pulmonic disorders*, *fevers*, etc., and to overcome *constipation* and regulate the bowels.

The indications for bryonia, according to Prof. Scudder, are "a hard, vibratile pulse, flushed right cheek, frontal pain extending to the basilar region, and irritative cough." Perhaps no remedy in the whole range of respiratory therapeutics is more valuable than this one, and much of the success of Eclectic physicians in the treatment of lung diseases is the result of the frequent use of specific bryonia. It is the remedy for the sharp, cutting, and lancinating pain with harsh cough. It is equally valuable when the pain is tensive and tearing, especially when aggravated by motion; the parts feel stiff, sore, or bruised, and there is a large quantity of mucus within the bronchioles, as evidenced by the loud mucous *rales*. When the pulse is hard, frequent, and vibratile, and the temperature is elevated, bryonia is indicated. A prominent indication is the flushed right cheek just above the malar bone. It acts best in small doses. It frees the circulation, overcomes capillary obstruction, lowers temperature, and controls pain. It is the remedy for *inflammation of serous tissues*, and is equally valuable in *peritonitis* and in *synovial inflammations.* It lessens nervous excitation and erethism, and promotes secretion and excretion. In *rheumatic conditions of the chest* and in *pleurodynia*, it is valuable, especially if the pain be sharp, and is aggravated by motion. Its best results are observed in *pleurisy*. In simple pleuritis from cold aconite alone is sufficient; but that form of pleurisy which is insidious and complicated, is best treated with bryonia, and in the second stage it hastens the removal of effused material. In the so-called "*bilious*" *pleurisy*, with jaundice and a burning sensation in the lungs, and tenacious mucous expectoration, it proves an excellent drug. In *pleuro-pneumonia* it may be given for its absorptive qualities. *Bronchitis*, with frothy, blood-streaked expectoration; *pneumonia*, with sharp pleuritic pain, or with harsh, harassing cough; and in *cough* aggravated or excited by talking, walking, or tickling in the throat, or by vomiting, it is always indicated. It is beneficial in *typhoid pneumonia*, but should be associated with baptisia. It is valuable in *phthisis* to control pain, lessen temperature, and to allay the troublesome cough. Probably no remedy, excepting gelsemium, was so frequently indicated to control cough and pain in the recent epidemics of "*la grippe*." In nearly all cases in which bryonia is employed it should be associated with aconite, veratrum, lobelia, or gelsemium, as indicated. As a remedy for *cough*, independent of bronchopulmonary complications, it is valuable where the trouble originates in the larynx and trachea, especially that painful cough seemingly located between the suprasternal notch and the bifurcation of the trachea. Such a cough is irritative, and generally due to a nervous erethism, which is controlled by bryonia. The cough is dry, rasping, hacking, or explosive, and always attended with more or less tensive or sharp pains. But little, if any, secretion is present, unless it be a small quantity of white or brown, blood-streaked or clotted, frothy mucus. Tickling, irritative cough, aggravated by swallowing food, talking, or upon entering a warm room—the kind of cough produced by cold—is always benefited by bryonia. The bryonia condition is one of debility, and the patient perspires readily. It is a remedy for *fevers*, and will often control them when the special sedatives fail. Chilliness, with a sensation of tension, and that form of cutaneous weakness in which one easily sweats, upon movement, are the conditions for it. Add to this the peculiar bryonia pain, given above, and deepened color of mucous tissues, and full veins, evidencing capillary obstruction, frontal headache, dry tongue, and tendency to delirium—and the bryonia case is complete.

"Aggravated by motion" has long been a phrase applied to bryonia cases, and so we find in these cases a lethargy induced more by a desire to remain quiet than one of dullness, as is noticeable when belladonna is required. The patient is languid, torpid, tired, and has little inclination to go about. A general deficiency of nervous balance is observable, and every effort tends to induce perspiration. With this may or may not be associated the bryonia headache, pain from the frontal region to the occipital base; thinking is an effort, and the patient is irritable if disturbed. Temperature is slightly increased, and the tissues contracted. When any special organ is affected, extreme tenderness and soreness is experienced upon pressure. Thus in *hepatic disorders* with jaundice, high-colored urine, and developing pain upon pressure, it is an excellent drug. Stitching, sticking, or cutting pains about the liver, as if the serous capsule were involved, also indicates bryonia. In *acute rheumatism*, especially where the joints are swollen and feel stiff, it is direct in its action, and is equally valuable in chronic cases; painful and stiff *rheumatism of the spine* in children, *rheumatic headache*, sharp, temporal pain, *frontal headache, hemicrania*, with tender scalp, and sharp, tearing pains, made worse by motion, are all conditions for this drug. According to Prof. Locke, it is an absolute specific in *rheumatic swelling of the finger joints.* It is a remedy for *ovarian* and *menstrual wrongs*, with soreness on pressure. *Acute mammitis* is usually controlled by phytolacca, but when very painful and with elevated temperature, and the mammary glands are swollen, tender, and knotted, bryonia and aconite should be associated with the former.

Partial deafness from cold, or from scarlet fever with swollen glands; *chronic orchitis, rheumatic paralysis, scrofulous conditions of the ears and eyes*, and *scrofulous ulcers* and *white swelling*, with stinging, burning pain, are relieved by bryonia (Locke). Tensive pains in the ear in children call for bryonia. Prompt results were obtained from bryonia in an inveterate case of *facial neuralgia* of 6 years standing, by Prof. W. B. Scudder (*Ec. Med. Jour.*, p. 144, 1894). The patient had a weak heart, and cold hands and feet, a countenance like one accustomed to morphine, and fugitive, lightning-like pain, involving the left side of the head and left eye, coming on at intervals of a half minute, and lasting a few seconds. So severe was the pain that the patient had to grasp a chair to support himself during the paroxysm. A peculiarity of the case was a hyperæsthetic spot upon the upper lip and gum the size of a silver dollar, so sensitive that even the contact of a soft cloth could not be borne. Bryonia is the remedy for *rheumatic iritis*, with aching soreness upon movement of the eyeball; also in non-edematous puffiness of the upper eyelid.

Bryonia seems to be a valuable heart tonic in weak and delicate individuals, who, by overwork and nervous excitation bring on a depressed and irregular heart-action (*heart-strain*); and even in organic heart troubles when exposure and rheumatic twinges bring on the cardiac paroxysm, bryonia, with rest in bed, is asserted to powerfully and rapidly influence the condition for good.

In *peritonitis* the pain requiring bryonia is of the character of colic, but is marked by unusual tenderness and tension. Bryonia is valuable in *pericarditis* tending to *hydropericardium*, and in *brain disorders* with serous exudation.

Bryonia should not be forgotten in ordinary *indigestion*, where the food lies heavily, as if a stone were in the stomach. Ordinary *jaundice* is often cured with it, and in *typhoid fever*, as soon as pulmonic complications ensue, the patient should be put upon bryonia. Some cases of *infantile constipation* are said to be benefited by bryonia, especially such as are due to gastric disorders arising from difficult digestion of cow's milk. It does not, however, benefit all cases. Scudder calls especial attention to its use in the abdominal tenderness and pain in *typho-malarial fever*, and *zymotic diseases*, and associated with ipecac or euphorbia in *cholera infantum*, with abdominal tension and tenderness, or articular pain and swelling (*Dis. of Child.*, p. 31).

Bryonia should never be given in large doses. The usual prescription reads Specific bryonia, gtt. v to x, aqua fl℥iv. Dose, a teaspoonful every 1 to 3 hours, as indicated. Some, however, and Prof. Locke particularly, prefer the first decimal dilution of specific bryonia, of which from 5 to 20 drops should be added to 4 ounces of water, and the dose of which is 1 teaspoonful. Tincture of bryonia may be given in doses of a fraction of a drop to 1 drop.

Specific Indications and Uses.—Sharp, cutting, lancinating, or tearing pain, from serous inflammation; pain in serous cavities, with muscular tension and tenderness on pressure; tensive, sharp, tearing pain, with a sore feeling in any part of the body as if bruised, and always *aggravated by motion;* dry, sensitive skin; hard, moderately full, or hard, wiry, vibratile pulse, tensive rheumatic pain, made worse by motion; headache on right side, with flushed right cheek above malar bone (a prominent indication); frontal pain extending alongside of head to basilar region; hyperæsthesia of face or scalp; head so sore that one can not bear to be touched; pleuritic pain; neuralgic pain with hyperæsthesia; irritative, hacking, rasping, or explosive cough, with soreness or bruised feeling of parts, and with laryngeal and suprasternal soreness and tenderness; abdominal pain with tenderness; ocular tenderness, increased by movement; tensive earache; articular and synovial pain, swelling, and tenderness; bowels constipated and urine scanty; burning in eyes and nose, with acrid nasal flow; apathy or lethargy short of dullness, from disinclination to move on account of aggravation of condition; tired, weary feeling, too tired to think; disposition to perspire on the slightest movement.

Related Species and Drugs.—TAYUYA ROOT. This Brazilian root is said to be that of the *Trianosperma ficifolia.* It is proposed as a remedy for *scrofula, tertiary, syphitis, dropsy, paralysis*, and *stubborn skin diseases.* Dose of tincture, 5 to 15 drops.

Bryonia africana, Thunberg. South Africa. Used like bryonia.

Bryonia americana, Lamarck. West Indies. Employed for same purposes as bryonia.

Corallocarpus epigæa, Hooker filius (*Bryonia epigæa*, Rottl.). A native of Java, and considerably employed by the natives of India, where it is found also, as a valuable remedy for *snakebites, dysentery*, and *syphilitic disorders.* The tuber is somewhat turnip-shaped, large, often weighing 5 or 6 pounds, has a subacid, bitter taste and is mucilaginous. The viscid juice which exudes upon cutting the tuber hardens into an opalescent gum. The root is cathartic and anthelmintic. M. Jules Lepine, of Pondicherry, found in it a yellow bitter body refusing to crystallize, and thought to be probably indentical with *bryonin* (Dymock, *Mat. Med. of Western India*). *Bryonia laciniosa*, Linné, also found in India, is aperient and tonic. The whole plant, in fruit, is used.

BUCHU (U. S. P.)—BUCHU.

"The leaves of *Barosma betulina* (Thunberg), Bartling et Wendland, and *Barosma crenulata* (Linné), Hooker"—(*U. S. P.*).

Nat. Ord.—Rutaceæ.

COMMON NAME: *Buchu*

ILLUSTRATIONS: Bentley and Trimen, *Med. Plants*, 45, 46.

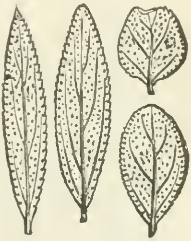
The synonymy of the official plants yielding buchu is somewhat uncertain. The following are generally recognized:

I. *Barosma betulina*, Bartling (*Diosma crenata*, De Candolle and others; *Diosma betulina*, Thunberg).

II. *Barosma crenulata*, Hooker (*Barosma crenata*, Kunze; *Diosma crenulata*, Linné; *Diosma crenata*, Linné; *Diosma odorata*, De Candolle).

Botanical Source.—The official buchu leaves are derived from plants which are chiefly differentiated from each other by their leaves. They are both slender, smooth, perennial shrubs, having twiggy, somewhat angular branches, of a purplish-brown color, and reach a height of from 2 to 3 feet. The flowers are white or pinkish. The leaves are opposite, or nearly so, and are almost sessile, or, at best, having but a very short petiole. Five upright carpels, each containing a single oblong, shining black seed, comprise the fruit. The leaves are conspicuously marked with oil glands appearing as pellucid spots. The leaves of other species also appear in commerce, conspicuous among which are those of the *Barosma serratifolia*, Willdenow.

Fig. 51.



Buchu leaves.

History.—The plants yielding buchu are indigenous to Southern Africa, occupying a limited extent of territory. According to Burchell they are odoriferous, and are, when powdered, used by the Hottentots under the name of *Bookoo* or *Buku*, for anointing their bodies. They likewise prepare a buchu brandy by distilling the leaves with wine, and which they employ as an efficient remedy in all affections of the stomach, bowels, and bladder; they also apply a decoction of the leaves to wounds. Buchu is said to have been introduced into medicine by a London drug firm (Reece & Co., in 1821), to whom a supply had been sent by Cape Colonists, who learned its uses from the Hottentots (*Pharmacographia*). Buchu leaves have a strong odor, resembling somewhat that of pennyroyal, and a corresponding taste. When held up to the light translucent dots may be observed, owing to the fact that the under surface of the leaves is beset with scattered glandular oil-points. If buchu leaves be preserved with ordinary care, their odor will remain for some years. The long variety of buchu is occasionally adulterated with leaves of *Empleurum serrulatum*, Aiton (*Rutaceæ*), a shrub growing in the same locality with buchu. They have a different odor from buchu, a bitter taste, are narrower than buchu leaves, and the oil-gland at the apex, present in *B. serratifolia*, is absent. Moreover, the adulterant has leaves with an acute apex, while those of long buchu are truncate. The leaves of another species of the same order, the *B. Eckloniana*, Berg, has also been imported with true buchu. They are markedly crenate, have a *rounded base*, and are grown on *pubescent* twigs (*Pharmacographia*).

Description.—Buchu is described in the *U. S. P.* as follows: "About 15 Mm. (½ inch) long, roundish-obovate, with a rather wedge-shaped base, or varying between oval and obovate, obtuse, crenate or serrate, with a gland at the base of each tooth, dull yellowish-green, thickish, pellucid-punctate; odor and taste strongly aromatic, somewhat mint-like, pungent and bitterish"—(*U. S. P.*). The two official species of buchu constitute the *short* (*round*) *buchu* of commerce. The leaves of the *B. betulina* compose the greater amount of this grade. They range from ½ to ¾ inch in length, and possess more rigidity than the second species. These leaves are obovate and wedge-shaped toward the petiole, and usually have the apex curved backward. The margins are bordered with sharp serratures, an oil-gland being set at the base of each serrature. This variety varies somewhat in size and shape. The second species, *B. crenulata*, has longer leaves (from ¾ to 1½ inch), which have a crenately serrulate margin, each indenture having an oil-gland situated at the bottom of it. They may be oval, oblong, or obovate, and are narrower than the preceding variety. The longer and large leaves constitute the commercial *intermediate buchu*. This species presents but little variation in the size and shape of its leaves. The *long buchu* of commerce is that derived from the *Barosma serratifolia*, Willdenow (*Diosma serratifolia*, Curtis), official in the *U. S. P.*, of 1880. These leaves differ considerably from the preceding, having a lance-linear form, irregularly narrowing towards each extremity, and have a truncate apex furnished with an oil-gland. They range from 1 to 1½ inch in length, and have a sharply serrulate margin, each serrature containing an oil-cell.

Chemical Composition.—Buchu leaves have been analyzed by Brandes and Cadet de Gassicourt, and later by Flückiger, Hanbury, and P. W. Bedford. Gassicourt found them to contain volatile oil (0.665 per cent), gum, extractive, chlorophyll, resin, lignin, etc. The leaves also contain mucilage. Their virtues are chiefly due to the volatile oil and extractive, which they yield to alcohol, or water. The oil has a powerful penetrating odor, somewhat like that of peppermint. Different amounts of the volatile oil were obtained by the above-named investigators, that derived from the long buchu being of lesser quantity than that from the short leaves. According to Schimmel & Co. (*Semi-Annual Report*, Oct., 1893), the percentage yield from *B. betulina* is 2 per cent, and from *B. serratifolia* 1 per cent. On subjecting this volatile oil to a low temperature, a stearopten, known as *diosphenol* ($C_{14}H_{22}O_3$), or *barosma camphor* separates, which may be recrystallized from alcohol in needles. When pure they are colorless, and, according to Flückiger, have a nearly pure peppermint odor. They dissolve freely in carbon disulphide. Barosma camphor is present only in a small amount in the *B. serratifolia*, while the *B. betulina* is very rich in diosphenol. The specific gravity of the oil from the last variety (*B. betulina*) is 0.944, at 15° C. (59° F.), while that from the *B. serratifolia*, after elimination of diosphenol, which separates at ordinary temperature, is 0.969, at 15° C. (59° F.) (Schimmel's *Report*). Diosphenol can not be distilled without decomposition. Both Brand and Landerer had observed bodies to which they gave the name *diosmin*. That of the former was a bitterish body, while that of the latter was probably the stearopten diosphenol, as he observed it in a tincture of buchu, which had been made for some length of time. Prof. E. F. Wayne obtained salicylic acid by distilling the leaves. Others have failed to find it. The ash of buchu leaves contains considerable manganese. Barosma crenulata was examined by Spica, who found an oil differing somewhat from that of the other observers, and the diosphenol obtained he regarded as an oxycamphor. From the greenish-yellow mint-like oil he obtained a body, the odor of which resembled thymol. To this body he applied the name *dioscamphor*. From the residue after the extraction of the oil he obtained, by means of alcohol, a substance to which he gave the name *diosmin* (*Ph. J. Tr.*, 1885).

Action, Medical Uses, and Dosage.—Buchu is an aromatic stimulant and tonic. It promotes the appetite, relieves nausea and flatulence, and acts as a diuretic and diaphoretic. In favoring the urinary secretion it augments both the solid and watery constituents. On the other hand, when the kidneys are excessively active, their action is restrained by buchu. It is principally used in chronic diseases of the urino-genital organs, as in cases of *chronic inflammation of the mucous membrane of the bladder*, *irritable conditions of the urethra*, in urinary discharges with increased deposit of uric acid, and in incontinence connected with diseased prostate. Profuse muco, or muco-puruluent discharges, with vesico-renal irritation, point to its use. It is a remedy where irritation depends upon altered secretions from the urethral glands. Acid urine, with continual desire to urinate and when but little relief is experienced from the effort, calls for buchu. *Catarrh of the bladder*, from the extension of gonorrhœa, from irritant injections, or due to gleet, is relieved by it. For this use, as well as for long-standing *cystic irritability*, the patient having difficulty in restraining his urine, administer the following: ℞ Specific barosma, fl℥iiiss; tinct. chloride of iron, fl℥ss. Mix. Sig. A teaspoonful 4 times a day in a wine-glassful of infusion of hops or in sweetened water. Upon the prostate gland it is said to resemble thuja in its action, though it is less powerful than the latter. Some have found it beneficial in *dyspeptic, cutaneous*, and *rheumatic affections*. I do not, however, think it equal to many of our indigenous remedies, which are sadly neglected by the profession, in their eagerness for something at a distance from home. Were our native plants more closely investigated, there would be but little use for foreign, and consequently expensive agents (Prof. King). Under favorable circumstances a warm infusion of buchu leaves will cause diaphoresis. Dose of the powder, from 20 to 30 grains, 2 or 3 times a day; of the infusion, 2 to 4 fluid ounces, 3 or 4 times a day; of the tincture, 1 to 2 fluid drachms; specific barosma, 10 to 60 drops, well diluted, from 3 to 6 times a day.

Specific Indications and Uses.—Abnormally acid urine, with constant desire to urinate, with but little relief from micturition; vesico-renal irritation; copious mucous, or muco-purulent discharges; cystorrhœa.

BUXUS.—BOX.

The leaves of the *Buxus sempervirens*, Linné.

Nat. Ord.—Euphorbiaceæ.

COMMON NAME: *Box.*

Botanical Source.—Buxus sempervirens is a small, dense-leaved, hard-wooded, evergreen tree. Its leaves are ovate, opposite, of a deep, shining green, becoming red in the autumn, quite smooth and entire, with the cuticle of the underside readily stripping off; the petioles and young branches are slightly downy; the flowers aggregate, axillary, and pale-yellow; the capsule is globular, 3-horned, tricoccous, 6-seeded, and bursts elastically; the seeds are parallel, oblong, slightly compressed, and externally rounded (L.).

History.—This is an exotic, though generally well-known plant, growing on dry, chalky hills in Europe, and the west of Asia. One variety of it, the *B. suffruticosa* (*Dwarf-box*), with obovate leaves, and a stem scarcely woody, and which is much esteemed for borders along the walks of gardens, possesses similar medicinal virtues. It is of very slow growth, a tree 8 feet high must be 100 years old. The wood is yellow, very hard, and much used by wood-engravers for wood-cuts; also for other purposes. The leaves, which are the parts used, are bitter and nauseous, and impart their properties to water or alcohol. The bark has been used to some extent to adulterate pomegranate bark.

Chemical Composition.—The bark of box-tree was found by M. Fauré to contain among chlorophyll, wax, resin, gum, ash, etc., a bitter alkaloid, which he named *buxine*. This alkaloid was obtained by exhausting the powdered bark with alcohol, evaporating the liquid, dissolving the residue in water, and treating the solution with ammonia. The precipitate thus obtained was digested in alcohol, which, being evaporated, left a dark-brown translucent mass, which is the buxine. It is bitter, causes sneezing, is insoluble in water, slightly so in ether, readily so in alcohol, and is difficult to obtain white, even when treated with animal charcoal. It colors red litmus blue, and forms neutral salts with acids. Nitric acid added to the sulphate of buxine, removes a resinous matter and leaves the sulphate of buxine pure; from this salt, pure buxine may be obtained in crystals.

Buxine was shown by Walz (1860) to be apparently the same body as bebeerine (from *Nectandra Rodiæi*, Schomburgk, or bebeeru bark), which observation was confirmed by Prof. Flückiger (1869), who has further shown that both *bebeerine* and *buxine* do not differ essentially from *pelosine*, an alkaloid derived from both *Cissampelos Pareira*, Linné (*Common False Pareira brava*), and *Chondodendron tomentosum*, Ruiz et Pavon (*True Pareira brava*). A second alkaloid, discovered by Pavia, and investigated by Rotondi and Pavesi, received from the latter investigator the name *parabuxine* ($C_{24}H_{48}N_2O$). Still another alkaloid, *parabuxinidine*, in the form of prisms, without color, and capable of producing a deep-red hue with turmeric paper, has been announced by Barbaglia (*A. J. P.*, 1885). It dissolves in alcohol and ether, but not in water. An alcoholic solution of oxalic acid yields a heavy crystalline precipitate with solutions of the alkaloid. Tannin is said to be present in the leaves, as well as a fetid volatile oil.

Action, Medical Uses, and Dosage.—Cathartic, sudorific, alterative, and anthelmintic. It may be used, in syrup or extract, in all diseases where an alterative is required. In doses of 10 or 20 grains of the powdered leaves, it proves an excellent vermifuge. The dose of a strong decoction, or syrup, is from ½ fluid ounce to 1 fluid ounce, 3 or 4 times a day. And in combination with the stillingia and corydalis, in the form of a syrup, it forms a very useful tonic and alterative in *syphilis.* Reputed to possess antispasmodic virtues, and to have been beneficially used in *epilepsy*, *chorea*, *hysteria*, etc., but requires further corroboration. Chips of the wood are said to have the same properties, and have been prescribed in *secondary syphilitic diseases*, and *chronic rheumatism.* A fetid empyreumatic oil, *oleum buxi*, was formerly prepared, but the use of which has become superseded by the preparations of guaiacum; it has, however, been successfully used in *toothache.* Camels who eat the leaves are said to become poisoned.

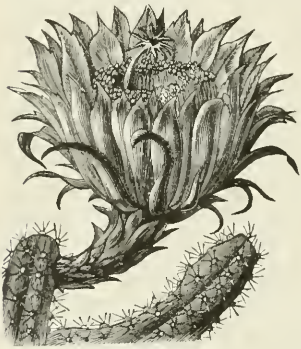
CACTUS.—CACTUS.

The fresh (green) stems and flowers of *Cactus grandiflorus*, Linné (*Cereus grandiflorus*, Miller and De Candolle).

COMMON NAMES: *Night-blooming cereus, Large-flowered cactus, Sweet-scented cactus, Vanilla cactus.*

Botanical Source.—Cactus grandiflorus is a creeping, rooting, fleshy shrub, having cylindrical or prismatic stems, with about 5 or 6 not very prominent angles, branching, and armed with clusters of small spines, arranged in radiated forms. The flowers are terminal and lateral, from the clusters of spines, very large, 8 to 12 inches in diameter, expanding at night, enduring for a few hours, and exhaling a vanilla-like odor. The petals are white, spreading, and shorter than the sepals; the sepals are linear-lanceolate, brown without, and yellow within. The fruit, or berry, is ovate, covered with scaly tubercles, fleshy, and of an orange, or fine reddish color. The seeds are very small and acid.

Fig. 52.



Cactus grandiflorus.

History.—Cactus grandiflorus (*Cereus grandiflorus* of De Candolle), *Night-blooming cereus*, also known by the names, *Vanilla cactus*, *Sweet-scented cactus*, *Large-flowered cactus*, is indigenous to Mexico and the West Indies, and also grows in Naples, where it blooms in July. In Mexico it was, at one time, a popular remedy for various diseases, as irritation of the kidneys and bladder, intermittent fever, difficulty in breathing, cough, etc. It is rarely met with in the higher temperate latitudes, where it is of difficult culture. Night-blooming cereus is a handsome and very showy shrub. Its blossoms commence expanding about 6 or 7 o'clock in the evening, and are fully blown about midnight; but about 3 or 4 o'clock in the morning, they are quite decayed; during its continuance, however, there is scarcely any known flower of greater beauty. The perianth, when open, measures nearly a foot in diameter; the outer leaflets are of a dark-brown color, the inner ones are of a splendid yellow, gradually shaded, toward the center of the flower, into a pure and brilliant white. These flowers are delightfully fragrant, and fill the air with odors to a considerable distance. When the flower has withered, the ovary enlarges and becomes pulpy, and forms an acid juicy fruit, having some resemblance to a gooseberry. The plant was introduced to the medical profession by Dr. Scheele, of Germany; but little attention, however, was given to it, until Dr. R. Rubini, a Homœopathic physician of Naples, brought it into especial notice as a remedy in heart diseases. The parts of the plant used in medicine are the flowers and young and tender stems, which should be gathered in July, and at once made into a tincture. The plant is mucilaginous, and when beaten in a mortar forms a viscid magma. No satisfactory analysis has been made of this plant, nor has it been satisfactorily ascertained whether the plant growing in its natural latitudes has any more powerful action than that cultivated in higher temperate latitudes.

Action, Medical Uses, and Dosage.—Cactus impresses the sympathetic nervous system, and is especially active in its power over the cardiac plexus. In sufficiently large doses it acts as an intense irritant to the cardiac ganglia, producing thereby irritability, hyperæsthesia, arythmia, spasm and neuralgia of the heart, and even carditis and pericarditis. According to E. M. Hale, M. D., it acts upon the circular cardiac fibers, whereas digitalis acts upon all the muscular fibers of the heart. Like the latter, as a secondary effect of over-stimulation, it may induce heart-failure. The tincture, in large doses, produces gastric irritation, and also affects the brain, causing confusion of mind, hallucination, and slight delirium. In excessive doses, a quickened pulse, constrictive headache, or constrictive sensation in the chest, cardiac pain with palpitation, vertigo, dimness of sight, over-sensitiveness to noises, and a disposition to be sad or to imagine evil, are among its many nervous manifestations. Melancholia often follows such action. It is generally conceded, however, that the mental, cerebral, gastric, and other effects are secondary to and dependent largely upon the primary effects of the drug upon the heart.

In medicinal doses, night-blooming cereus diminishes the frequency of the pulse, and increases the renal secretions, and is, therefore, sedative and diuretic. According to Prof. Scudder (*Spec. Med.*), it neither increases nor depresses innervation; that it is neither stimulant nor sedative. Prof. Locke, on the other hand, believes it sedative, but not depressant (*Syllab. of Mat. Med.*). In such doses it does not appear to weaken the nervous system in the least. The special field for cactus is *diseases of the heart*, in which it exerts a very decided action, palliating or removing the symptoms, and frequently giving prompt relief. This influence upon the heart is manifested when the disorder is functional; organic conditions are only benefited in a measure. However, our Allopathic antagonists, who are generally skeptical regarding the virtues of plants which do not possess unusually powerful properties, consider cactus as a valuable agent in *mitral regurgitation*, due to valvular lesions. In our school, however, it is recognized chiefly as a *functional* remedy, and one of the best of cardiac tonics. There is no doubt but that the continued use of the drug tends to increase cardiac nutrition and waste, and in this way may benefit cases with structural lesions. The influence of cactus is exerted wholly upon the sympathetic nervous system, through the superior cervical ganglion, expending its force in regulating the action of the heart and controlling the cerebral circulation, thus giving increased nutrition to the brain. It is the remedy for almost all *functional cardiac irregularities*, as *palpitation*, *pain*, *cardiac dyspnœa*, *intermission in rhythm*, etc. Even in structural heart-wrongs, the majority of unpleasant symptoms are due to disordered innervation, and this condition is corrected by cactus. It does not seem to make any difference whether the heart-action be feeble, violent, or irregular, provided it be due to lack of innervation, associated with mental depression, or in excitable or nervous individuals, the remedy relieves, because its tendency is to promote normal rythmic action of the cardiac muscle. In *spasm of the heart-muscle*, and in *cardiac pain* of a constrictive character, as if the organ were held with a strong band, it is the most prompt of all cardiac remedies. It is a good remedy in the heart troubles produced by tobacco. In *palpitation*, *angina pectoris*, *cardiac neuralgia*, *rheumatism*, or *hypertrophy*, *valvular disease*, etc., it is of much benefit, often giving great relief, even in incurable cases. It has been likewise found serviceable in some cases of *dropsy*, and in tendency to, or in incipient *apoplexy*. *Pulmonary hemorrhage*, particularly that accompanying phthisis and in advanced *interstitial pneumonia*, prompt results may be expected from cactus. Its use should be associated with iron in anemic cases, with tonics where great debility exists, with antiscrofulous agents where there is a scrofulous disposition, etc. When associated with cardiac weakness and irregularities, and in so far as they depend upon these conditions, it has likewise been found useful in *cerebral congestion*, *mental derangements*, *rheumatism*, *inflammations of mucous membranes*, *prostatic diseases*, *irritable bladder*, *renal congestion*, *general dropsy, œdematous condition of the limbs, dysmenorrhœa, chronic bronchitis,* etc When a vigorous and healthy action of the heart obtains under its use these troubles pass away.

Cactus is recommended in *visual defects* of an asthenopic character, and in *exophthalmic goitre,* due to functional heart disease; *tinnitus aurium,* from the same cause, is benefited by it. These eye and ear disorders are not benefited by it when the cardiac disorder is of an organic nature.

The peculiar state of the nervous system in cardiac diseases, calling for cactus, is quite characteristic. There is a marked mental depression, often amounting to hypochondria and fear of impending death. Associated with these are præcordial weight and oppression and difficult breathing. During the menstrual period and at the menopause, nervous women frequently experience unpleasant cardiac disturbances of a functional character. These are promptly relieved by cactus. For the *nervous menstrual headache,* Prof. Locke recommends: ℞ Specific cactus, gtt. x to xxx; aqua, fl℥iv. Mix. Sig. Dose, a teaspoonful 3 or 4 times a day. It has a marked control over the nervous system, somewhat like that of pulsatilla.

The effects of cactus are permanent and not merely temporary. The nutrition of the heart is increased, the contractile power augmented, and the irregular movements regulated.

The dose of tincture of cactus (plant, ℥iv to alcohol, 98 per cent, Oj) is from a fraction of a drop to 10 drops; of specific cactus, a fraction of a drop to 5 drops.

Specific Indications and Uses.—Impaired heart-action, whether feeble, violent, or irregular; cardiac disorder, with nervousness, præcordial oppression, anxiety, apprehension of danger, or death; hysteria; tobacco heart; nervous disorders, with heart complications.

Related Species.—Many species of the cactus family have been used for food and medicine; others furnish acid fruits which yield a refreshing juice to thirsty travelers, while the seeds of some species have been roasted and made into bread. The Opuntias, growing wild in Texas, are roasted and fed to cattle, and it is recorded that horses and mules will crush with their hoofs various members of the order Cactaceæ to obtain the acid juices, of which they are exceedingly fond. The following represent a few of the species which have been employed more or less as a medicine, or for some other economic purpose:

Cactus flagelliformis, Linné (*Cereus flagelliformis,* Miller).—Red or pink flowers; stem-branches spiny, verrucose, 10-angled, slender, weak and prostrate, and many feet long. This plant has an acid juice and wooly fruit. Buchner (1836) found it to contain albumen, mucilage, bimalate of calcium, and acetate of potassium. Its juice is said to possess anthelmintic properties.

Cactus fimbriatus, Lamarck (*Cereus fimbriatus,* De Candolle).—Stock 8 or 10-angled and erect; spines clustered; flowers rose-pink; and fruit red and acid. The juice of the plant is acrid.

Cactus paniculatis, Lamarck (*Cereus paniculatis,* De Candolle).—Stock 4-angled; branches spiny and crenated. The whole plant is tree-like, and bears sweetish-acidulous, yellowish fruit (berry).

Opuntia vulgaris, Miller (*Cactus Opuntia,* Linné). *Prickly pear, Indian fig.*—Stock prostrate, glaucous, with minute, scale-like leaves, a few spines and numerous bristles. The flowers are large and yellow. The fruit ovoid, almost smooth, slightly bristly, crimson when mature, and edible, having a sweetish, acidulous taste. According to careful analysis by Miss De Graffe (*A. J. P.,* 1896) neither alkaloids, glucosids, nor tannin occur in the fruit, but sugar is present in comparatively large amount. Used as a discutient, and the decoction is mucilaginous. Grows in the West Indies and from Connecticut to Texas, delighting in rocky situations. This species is said to effect the intestinal mucous surfaces and probably the abdominal nerves. *Diarrhœa,* with excessive nausea, is reputed to have been cured by Opuntia vulgaris.

Melocactus communis, Link et Otto (*Cactus Melocactus,* Linné).—West Indies. Stock succulent, round-ovate, about a foot high, and from 12 to 18-ribbed, brown clustered spines; stock surmounted by what resembles a spadix, consisting chiefly of dense, woolly tufts, in the summit of which are imbedded the small red blossoms. The bruised stems are employed as a discutient. The red berries of this and other species are said to impart a red color to the urine.

Anhalonium Lewinii, Henning.—Habitat Mexico, where it is known as *Muscale buttons,* and employed for narcotic purposes. Lewin (1888) isolated an alkaloid, *anhalonine* ($C_{12}H_{15}NO_3$). The anhalonium is said to grow on high chalk-cliffs and on almost inaccessible mountain peaks. Anhalonine paralyzes the spinal-cord, and increases reflex action, and may produce tetanic symptoms. Vomiting is induced by small doses of it. The fruit has a somewhat prolonged intoxicant action. Anhalonium is reputed a cardiac tonic, and is said also to be a remedy for all forms of *dyspnœa* (?), and of value in *angina pectoris,* to control the painful paroxysms.

Mammillaria simplex, Haworth (*Cactus mammillaris,* Linné).—Stock ovate-oblong, simple, studded with tubercular mammillæ, having spines, and bearing white flowers and red fruit.

CADMII IODIDUM.—CADMIUM IODIDE.

Formula: CdI_2. Molecular Weight: 364.56.

Synonyms: *Iodidum cadmicum, Cadmium iodatum.*

Preparation.—Cadmium combines readily with iodine, either by heating the two substances together, or by boiling them in water till a solution is obtained. By evaporating this solution the iodide of cadmium crystallizes in 6-sided prisms. It may also be prepared by the double decomposition of 4 parts of iodide of potassium and 3 parts of sulphate of cadmium, and crystallizing from alcohol (absolute). It may further be made by dissolving cadmium in hydriodic acid.

Description.—Cadmium iodide crystals are white, with a silvery-satin or pearly luster resembling fish scales, transparent, permanent in the air, and melt very easily at 315.5° C. (600° F.), forming a liquid of an amber color. Strongly heated, the iodine is driven off. They are soluble in water and alcohol, from which solutions they are precipitated by the alkaline carbonates, furnishing carbonate of cadmium. With starch and chlorine, cadmium iodide yields a blue color, and with sulphide of hydrogen, a yellow precipitate. Its solution in water is of acid reaction. It is extensively employed by photographers.

Action and Medical Uses.—(For action, see *Cadmium*). Iodide of cadmium has been used as a substitute for iodide of lead, in external applications. It is said to produce the same beneficial effects as the latter agent, without any of its deleterious effects. It may be dissolved in glycerin, and must be applied by friction, in order to produce any effect. An ointment composed of 1 part of iodide of cadmium to 8 parts of lard has been found very useful in *chilblains*, some forms of *cutaneous disease, chronic inflammatory affections of the joints*, various forms of *nodes, scrofulous tumors*, etc.

Cadmium and its Compounds.—Cadmium. Symbol: Cd. Atomic weight: 111.8. This metallic element was discovered by Stromeyer and Hermann about the year 1818. It usually occurs associated with the oxide of zinc obtained in the manufacture of this metal, from which it is separated as indicated below. It occurs native in Scotland as *greenockite*, a sulphide of cadmium. It resembles zinc in many of its physical and chemical characteristics. It differs, however, from zinc in forming with sulphide of hydrogen a *yellow* precipitate, which, like zinc sulphide, dissolves in diluted acids, but is insoluble in potassium cyanide solution. Cadmium may be obtained by dissolving in diluted hydrochloric or sulphuric acid, the zinc ore containing it, or the oxides resulting from the manufacture of zinc, and then precipitating the cadmium with zinc. It may also be prepared by taking the solutions in acids, and precipitating cadmium sulphide by means of hydrogen sulphide, zinc sulphide remaining in solution. The yellow product is then dissolved in concentrated chlorhydric acid, a precipitate produced by adding carbonate of ammonium in excess, and finally distilling the well-washed and dried precipitate with lampblack. Cadmium has a white color, with a slight bluish-gray tinge, is soft, very malleable, crystallizes in regular octahedrons, is very fusible, melting before it becomes red hot, and at a temperature somewhat higher than the boiling point of mercury. It is volatile, collecting in drops and crystallizing as it cools. Cadmium breaks with a fibrous fracture, and may be rolled out as foil or drawn as wire, and when bent, crepitates like tin. Its density (molten) is 8.546, and (hammered) 8.667. Nitric acid, also hydrochloric and hydriodic acids, readily dissolve it. Its dark-yellow vapor burns with a deep-red flame. Its solutions in acids yield a characteristic yellow precipitate (CdS), with hydrogen (or ammonium) sulphide; insoluble in yellow ammonium sulphide (difference from arsenic). White precipitates are obtained with alkaline hydroxides, phosphates, soluble carbonated alkalies, oxalates, and yellow prussiate of potash. Zinc and copper are apt to be present as impurities. Cadmium salts, which are soluble, are powerful agents, producing vomiting, purging, slow pulsation, slow respiration, vertigo, prostration, insensibility, and painful convulsions. Simpson compared their effects to those of antimony, while Garrod, who introduced the iodide into practice, thought them more nearly related to zinc salts.

Cadmii Sulphas, *Sulphate of cadmium, Sulphas cadmicus, Cadmium sulphuricum* ($3CdSO_4 + 8H_2O$)=768.64).—This salt may be obtained by dissolving carbonate of cadmium, obtained by first making a solution of cadmium nitrate, and precipitating by the addition of sodium carbonate in diluted sulphuric acid, and evaporating the neutral liquid to crystallization; or, by dissolving 7 parts of cadmium in a mixture of 6½ parts of sulphuric acid, 15 parts of water, and a small portion of nitric acid. Evaporate the solution to dryness, dissolve the residuum in distilled water, filter, and evaporate to form crystals. This salt crystallizes in large, transparent, rectangular prisms, similar in appearance to sulphate of zinc. They are very soluble in water, effloresce strongly when exposed to the air, lose their water of crystallization at a low heat without fusing, and at a strong red heat are changed into tabular crystals of subsulphate of cadmium, which are not very soluble in water. Their taste is astringent and metallic. Its aqueous solution has an acid reaction.

The effects of sulphate of cadmium on the system are said to resemble those of sulphate of zinc, but are 10 times more active. Internally ½ grain has produced a copious flow of saliva, nausea, vomiting, and pain. It has been recommended as an irritant and astringent topical application in *affections of the eye*, *specks* and *opacities of the cornea*, etc. As an application in *chronic ophthalmia*, from ½ grain to 4 grains may be dissolved in a fluid ounce of water; in *otorrhœa* the solution may be made of double the above strength. In specks on the cornea, an ointment has been used, composed of 1 or 2 grains of the sulphate to 80 grains of prepared lard. *Cadmium bromide*, largely employed in photography, was formerly used in *epilepsy* by Roux, but was abandoned on account of its emetic effects. Two women were poisoned with it, the agent producing severe gastro-intestinal disturbances. *Cadmium carbonate* has poisoned the operator by inhalation, while he was using it to polish silver.

CAFFEA.—COFFEE.

The seeds of *Coffea arabica*, Linné.

Nat. Ord.—Rubiaceæ.

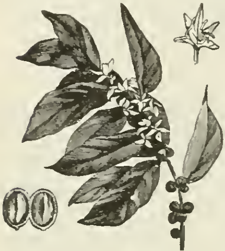
COMMON NAME: *Coffee*.

ILLUSTRATIONS: Köhler's *Medicinal-Pflanzen*, Plate 106. Bentley and Trimen, *Med. Plants*, 144.

Botanical Source.—(See *Cultivation and Collection*).

History and Description.—The coffee plant is a native of Arabia Felix and Ethiopia, and is extensively cultivated in Asia and America between the north and south latitudes of 56°. The plant is propagated from the seeds, which sprout in 3 or 4 weeks, and are sufficiently advanced in the course of 12 months for transposition. The fruit appears in about 3 years, and the ripening of the seeds may be known by the dark-red color of the berries, when they must be gathered, else they will fall spontaneously. The fleshy part is removed from the seeds by certain apparatus, and their thin covering is detached after drying. There are many varieties of coffee, the characters of which depend upon the soil, the locality and the method of cultivation. The origin of its employment is still surrounded with many obscurities. The *Mocha coffee* is esteemed the best, and the *Java* next; but the coffee consumed in this country is chiefly furnished from Brazil. Demarara, Jamaica, and other West India islands. Good coffee should be firm and solid, and heavier than water, in which it immediately sinks; a blackish-colored coffee, not compact, and floating on water, is an inferior article. *Mocha coffee* comes from Arabia, in small, yellowish, and almost round grains, and emits an agreeable odor when properly roasted. *Zanzibar* is frequently sold under the name of Mocha; its bean is rather small, its color the same, a little paler, of a light-yellow, slightly greenish; the grains are irregular, round, like those of Mocha, sometimes compressed like those of the Bourbon coffee; the odor and taste after torrefaction are like those of good Mocha. *Martinique*, a very good kind of coffee, presenting large, elongated grains, of a persistent greenish color, and covered with a silvery pellicle, which separates upon roasting; the longitudinal furrow is quite marked and very open. The coffee is rich in active principles, and has an agreeable odor on roasting. *Hayti* and *Porto Rico* are in more irregular grains, of a clearer green color, rarely provided with a pellicle. Taste and odor less agreeable than the preceding. *Bourbon*, or *Coffee of the Reunion*, is somewhat like the Mocha, but it is larger, not so round, equally yellowish, but less perfect in the agreeableness of its odor upon roasting. The inferior kinds of coffee improve by keeping, and if kept for several years before roasting, they yield a much more fragrant and agreeable infusion than when roasted shortly after they have been gathered. Coffee has a feeble, characteristic odor, and a rough, sweetish, peculiar taste.

Fig. 53.



Coffea arabica.

A distinct species of coffee shrub is cultivated in Liberia. It is the *Coffea liberica*, Hiern. It has been introduced into the isles of the Indian Ocean, and is said to be less prone to plant disease than the common coffee shrub.

According to Dr. Stenhouse, the *dried leaves* of coffee, roasted, form a very agreeable infusion, and which may be used as a substitute for tea and coffee.

They contain a much larger amount of *caffeine* than the coffee-bean, with caffeic acid, and the thought was at one time entertained that they would be extensively used in the same manner as tea. According to James Motley, Esq., the natives of Sumatra cultivate the coffee plant extensively, but use only the leaves, entirely neglecting the berries. They are fastened upon strips of bamboo, held over a clear blazing fire, until they acquire a rich, brownish-green color, and become perfectly crisp and brittle, then powdered and infused in boiling water, forming a dark-brown liquid of the odor of tea, but the flavor of a mixture of tea and coffee. This is much used by them as a beverage.

Roasted coffee is a powerful deodorizer, destroying the effluvia from decomposed animal and vegetable matter.

Cultivation and Collection.—The following excellent paper, by Mr. C. G. Lloyd, is here inserted in full by permission of the author, showing the modes of raising and gathering coffee in the West Indies, as described by the author in 1892:

The Cultivation of Coffee in Jamaica.—"The island of Jamaica exports each year between 800,000 and 900,000 pounds of coffee, valued last year at $1,360,000, and the product was last year 15.7 per cent of the total exports from the island. In former years the great bulk of the coffee went to England; thus only 10 years ago, England got 73 per cent, while the United States only received 13 per cent; but beginning with 1884, the States have taken a large proportion of the product, and last year received 45 per cent. the year before 57 per cent. I am very sorry to have to report. however, that the United States only gets the poorer grades, the English paying a better price for the choice grades. The best coffee of the island is raised on the Blue Mountains, in the parishes of St. Andrew and St. Thomas, the eastern end of the island, which coffee almost entirely goes to England. I am informed by the planters of Manchester parish, who sort their coffee, that their best grades, also, go to England.

"Jamaica (and also Hayti) coffee is of an average good quality, a little stronger than Java or Mocha, but not so strong and rank as the Rio. I presume every one who knows nothing of the subject, has an idea how coffee grows, even if it is erroneous. We naturally imagine that it grows on trees like cherries, and I had expected to see a coffee plantation look like a cherry orchard. (My impressions had been formed from the picture, plate 10, of the recent French work "*Plantes Medicinales*" of Dujardin-Beaumetz and Egasse. This plate is so grossly inaccurate, not only in regard to the character and apparent size of the coffee tree, but also to the size, shape, color, and cluster of the berries, that it is a discredit to that otherwise very excellent work. A good illustration of a coffee branch is plate 106 of the German work lately completed, Köhler's *Medicinal-Pflanzen Atlas*). When I left Kingston by rail for the interior of the island, a couple of weeks before Christmas, having been told that the coffee berries were then ripe, I kept a sharp lookout for the coffee trees, but saw nothing that I could take for them. On arriving at the station, I walked along the single road or street of the little village of negro huts, and chancing to stop by the side of a copse of tangled bushes, which I took for a wild growth, I noticed a few coffee berries on the ground under the bushes, and, on investigating, found that these bushes were coffee shrubs. I tried to think of what they reminded me at home, and nothing conveys to my mind a closer comparison than a tangled undergrowth of Wahoo shrubs.

"The bulk of the coffee of Jamaica is raised by small growers—negroes, who own from ½ to 5 acres of ground, and who plant the shrub around the place without any order or system whatever, and apparently give the shrub no attention, excepting to break off occasionally the tops when they get too high, or to cut off a few dead branches. In the statistics of the island, where the estates are specified which raise 50 acres or more of coffee, only 30 estates are named, comprising about 3,000 acres, while the acreage of small holders, less than 50 acres, is nearly 18,000. These small growers, of course, for the most part have no machinery for preparing or sorting the coffee. Almost every negro hut in the coffee districts has in the yard what they call a "barbicue." It is a flat drying surface, built where the sun will strike it, and reminds one of a square tray on a large scale, built of brick with raised edges and cemented smooth. The usual size is from 12 to 20 feet square. The negroes gather the coffee berries when they get ripe, a few each week, somewhat like we would pick gooseberries, one at a time. They put the berries into a wooden mortar and beat them, which separates the outer skins, which are washed away in buckets of water. The seeds are then put on the "barbicue" to dry. Without a close examination at this stage the product resembles large grains of coffee mixed with the imperfectly separated outer skins, but on closer observation we notice that each grain of coffee is enclosed in a thick, tough, cartilaginous skin. When the coffee has been dried on the "barbicue" this skin becomes brittle, and the negroes again beat it in the mortar to hull it out of this skin. Then the seeds are picked over by hand, the better part of them being sold to the little stores throughout the country, which we notice with the sign out, "Licensed to deal in agricultural products," and which pay Her Majesty's government 2 pounds each per year for the privilege. These small storekeepers send it to Kingston, from whence it is shipped abroad. Coffee merchants in Kingston and some of the merchants in the smaller towns, sort the coffee into grades according to size and weight of the berry. Most of the sorting is done by hand, though some have sizing machines, as described further on.

"On coffee plantations the same process is gone through, but on a larger scale, more systematic, and with the aid of machinery. The coffee shrub thrives best on new land, hence the portion of the plantation devoted to coffee growth is virgin soil cleared of its forest for this purpose.

"Around Mandeville, in Manchester parish, the land is now almost all pasturage, and I am told that the whole of it was originally cleared off for the growth of coffee many years ago in slave times, and having raised its crops of coffee and exhausted the ground for this purpose, it was sown in Guinea grass and used for grazing. To establish a coffee plantation the land is cleared of its trees, burnt over, and cleaned up. Then it is laid out by pegs into squares of 6 feet, and young coffee sprouts about a foot high are planted near each peg. These sprouts are generally obtained from beneath old shrubs, and are adventitious growths from seed dropped from the shrub, though sometimes nurseries are established for raising the young sprouts from planted seed. In these tropical regions, weeds and vines and wild growths of all kinds spring up very quickly, and with these the planter is constantly at war. Four times a year, at least, the fields should be gone over with a hoe and the weeds cut down. In 3 or 4 years the young coffee plants begin to bear, and the shrubs continue giving crops for about 30 years. The shrub, if left to grow, would reach the height of 12 to 15 feet, but on a plantation they are topped when about 4 feet high, and kept to about this height by breaking off the tops and such suckers as appear. The branches are slender, and when the shrubs are not crowded, spread nearly horizontal. The leaves are evergreen (as, indeed, are most of the shrubs and trees in the tropics), of a firm texture, smooth and shiny above. They are opposite, oval, entire, and borne on short petioles about ½ an inch long. They are 3 to 5 inches long, 2 to 3 inches wide, and are terminated by acuminate points.

"The flowers are white, borne in clusters of 3 to 6 in the axes of the leaves, and are exceedingly fragrant. The petals are 5, slender, spreading. The shrubs begin to blossom in February and continue in flower up to May; the fullest bloom is in March and April. Coffee does not blossom as our fruit trees, all at once, and go out of bloom in a week or two, but continues to bloom for about 4 months, and the crop in consequence ripens through the same length of time, and the planters are thus enabled to gather and care for it to better advantage than if it all ripened at once. The coffee season lasts from September to December, September and October being the principal months. The coffee berries are borne on short stalks in clusters of 3 to 6 in the axis of the leaves. When ripe they are about the size of cherries, but are oval (not globular), and slightly compressed on the side. Each berry consists of 2 seeds (familar to us as the green coffee of commerce), each seed enclosed in a thick, tough white skin, called the parchment skin, placed in the berry with 3 flat surfaces together, and surrounded with a small quantity of sweetened pulp, the whole enclosed in a thick skin like a Malaga grape. The color of the skin, when ripe, is red, not a bright red, like a cherry, but a pale, dull red.

"The berries are picked by negro and coolie women, who go over the coffee shrubs, picking the ripe berries into baskets, and are paid by measure. The price varies according to abundance of the berries, but is regulated so that a woman makes about 9 pence (18 cents) a day. Rats are very fond of the sweetish pulp that surrounds the coffee grains, and they climb the shrubs and gnaw off a great many berries. Birds are also said to pick them, and lizards—which are very numerous in Jamaica—are also charged with despoiling the fruit. This "rat" coffee is picked from the ground by the women, and comprises about ¼ of the crop. It furnishes a larger proportion of heavy grains than the berries gathered from the shrubs, as the rats are credited with selecting the largest and best berries, and it is kept separate in all subsequent operations. As the bulk of this coffee is supposed to be gnawed off by the rats, all coffee picked from the ground is called "rat coffee." It costs about double to gather it as when picked from the shrubs.

"The women bring the berries to the works, where they are measured and paid for by the "Busher," as the overseer of a coffee plantation is called. To prepare the coffee for market the berries are first run through a machine called the "pulper," which tears off the outer skins and pulp. A "pulper" is simply a large cylindrical wheel about 3 feet in diameter and 2 feet long, covered with corrugated iron, like a nutmeg grater, and arranged so that it revolves so close to another corrugated iron surface that the berries can not go through entire, but are caught by the rough surfaces and torn to pieces, the skins and pulp being carried through, the seed dropping beneath into a tank of water. The water serves to wash the grains, and also to separate the light from the heavy coffee; the former floating, are skimmed off; the latter sinking, are taken from the tank after the water is drawn away. Heavy coffee is much the better grade, and it is kept separate from the light in all subsequent operations. At this stage the coffee seeds are still enclosed in the "parchment skins," which are tough and can not be separated from the seeds when green; hence the next process is to thoroughly dry the seed in order to make the "parchment skins" brittle so they can be hulled off. For this purpose the seeds are spread on "barbicues" similar to those previously described, only, of course, on a larger scale. The "barbicues" of an ordinary sized plantation cover about an acre of ground, and are usually built on sloping ground and terraced. When it threatens a shower, and every evening to protect it from the rain and dews (which are heavy in the tropics), the coffee is raked into a pile in the center of each barbicue and covered with a wooden cover-shaped hopper. From 10 days to 2 weeks' exposure to the sun on the "barbicue" will dry the seeds so that they can be hulled. The "huller" is a large wooden wheel arranged to revolve like the wheel we see in brick-yards, but running in a circular narrow trough. The coffee is placed in this trough, and the wheel constantly running over it breaks off the brittle "parchment skins," being heavy enough for this purpose, but not so heavy as to crush the seeds. The coffee seeds are separated from the broken "parchment skins," called trash at this stage, by being run through a "fanner," similar to the fans of our threshing machines, which blows off the trash. There still remain closely adhering to many grains of coffee thin light gray skins called "silver skins,''which would hardly be noticed by the ordinary observer. To remove these skins and brighten the grains of coffee, it is further dried in the warehouse for 2 or 3 weeks, and again put through the "huller" and "fanner." The next step is to separate the "pea-berry coffee." A small percentage of the coffee berries, instead of containing the normal 2 seeds, have by abortion only a single seed. The grains of these single-seeded berries, instead of having a flat face, are rounded, and are called "pea berries." These "pea berries" are heavy and of the best quality, and bring a better price than the best grade of flat-faced grains. To separate them the coffee is run into a cloth belt slowly revolving at a slight inclined plane, the flat-faced grains being carried over the top, the rounded "pea berries" rolling off the bottom.

"The coffee is next graded according to the size of the grains by being run through a "sizer." This is a cylindrical screen, consisting of 4 sections of different sized meshes, the smallest holes near the top. The screen revolves at an incline, and the different-sized grains drop through the various sections according to size into bins beneath, the largest grained and best grade being carried through the cylinder. Finally the coffee is given to women who spread it on a table and pick out all the deformed or broken grains, which are called the "tringe." The best grades of coffee are put in tierces holding about 800 pounds, and mostly shipped to England. The poorer grades and "tringe" are put into barrels or bags for this country. I have given a description of the machinery which I saw in operation on the plantations. There are improved machines, I am told, but they are said to furnish no better results than the old ones. In concluding this article, I wish to acknowledge my indebtedness for information and other courtesies to John H. Nosworthy, the "Busher" of Somerset Plantation."

Chemical Composition.—König (*Die menschl. Nahr. und Genussmittel*, 3d ed., 1893), enumerates the following constituents of raw coffee beans, with percentage added: Water, 11.23; nitrogenous matter, 12.07; caffeine, 1.21; fat, 12.27; sugar, 8.55; nitrogen, free extractive matter, 33.79; woody fiber, 18.17; ash, 3.92. Earlier analyses, *e. g.*, that of Payen, have also demonstrated the presence of 0.003 per cent of essential oil. The amount of *caffeine* ($C_8H_{10}N_4O_2+H_2O$), which is the most important constituent of the coffee bean (see *Caffeina*), seems to vary in the different specimens examined, from 0.23 to 2 per cent, and more, according to older analyses. More recently, however, Paul and Cownley have observed a marked uniformity in the amount of caffeine in 4 specimens analyzed, varying only from 1.10 to 1.28 per cent (*Amer. Jour. Pharm.*, 1887). Coffee is also stated to contain a small portion of citric acid. Another important constituent is *caffeo-tannic acid* ($C_{15}H_{18}O_8$) (which is probably the same as Payen's chlorogenic acid). Hlasiwetz has shown this compound to be a glucosid, capable of being decomposed by prolonged boiling with caustic potash in excess, and afterward treating the solution with sulphuric acid, the process yielding caffeic acid ($C_9H_8O_4$), and grape sugar. To caffeo-tannic acid Hlasiwetz assigns the formula $C_{14}H_8O_7$. *Caffeic acid* (Hlasiwetz), forms pale-yellow crystals, yielding, as a rule, salts of the same color. When submitted to a roasting temperature the characteristic aroma of roasted coffee is evolved. *Caffeo-tannic* acid is an amorphous body, somewhat gum-like, soluble in water, and both this compound and caffeic acid yield protocatechuic acid ($C_7H_6O_4$), when melted with caustic potash. It yields a green color with ferric chloride, but is not precipitated by gelatin.

The caffeic acid isolated by Stenhouse from coffee leaves, in 1854, is probably identical with the *kinic acid* obtained later by Zwenger and Siebert (in 1861), from Java coffee. The latter, by oxidation with sulphuric acid and dioxide of manganese, yielded *kinone* (*quinone*). The *viridenic acid* of Rochleder (1848), is thought to be a mixture of several acids.

By roasting, coffee acquires new properties; it expands considerably, becomes lighter by 16 or 18 per cent, has a peculiar, agreeable odor imparted to it, and a bitterish, aromatic taste, owing to the products of the torrefaction, viz., a brown, aromatic oil, and a brown, bitter principle; the caffeine volatilizes to a slight extent. Paul and Cowley have shown that the amount of caffeine in roasted coffee is fairly constant, about 1.3 per cent. Palmitic, acetic, and carbonic acids are found among the products when coffee is roasted in a closed vessel. Methylamine, pyrrol, acetone, and hydroquinone, are also produced, as well as *caffeol*. The flavor of coffee depends upon its minute quantity of aromatic, volatile oil, *caffeol* ($C_8H_{10}O_2$), and if the roasting process is carried too far, this is dissipated, and the coffee then becomes bitter, without the aroma. The reactions of caffeol point to its being identical with saligenin methyl-ether. The roasting of coffee should be effected by a gentle heat, carefully watching the process, not driving it too rapidly; the coffee must be removed as soon as it becomes of a russet tint, friable, and emitting an agreeable aroma. Different qualities of coffee should never be roasted together, but each one separately, as one may require such a length of time for proper torrefaction as would either destroy the desired properties of the other, or, fail to develop them. To make a superior infusion, the grains should be roasted only as required for use, be at once ground, or pounded, then have boiling water poured upon the powder, in a proper vessel, the whole set over a fire and allowed to remain until the liquid begins to boil. Let it stand a couple of minutes after removal from the fire, and it is ready for use. Or, it may be made by percolation with boiling water. The soluble materials of coffee furnish the aromatic and bitter principles, for when coffee, not roasted, is exhausted by water and then roasted, it fails to impart these principles to boiling water. Roasted coffee should be of a chocolate color, should be used soon after roasting, and should be ground only as wanted, as otherwise it loses nearly all of its flavor and activity.

Adulterations.—Roasted corn, peas, beans, oats, rye, or potatoes, when added to coffee, may be known by the deep-blue, blackish-blue, or purplish-red color, which a solution of iodine imparts to the infusion; pure and roasted coffee in infusion is rendered of a deeper reddish-brown tint by the iodine (see *Chicory*). A few drops of tincture of chloride of iron, added to an infusion of coffee berries, gives a sap-green color and are recommended as a test for the genuineness of essence of coffee. Whole coffee is most generally adulterated by mixing it with the inferior grades of berries variously pigmented with coloring agents. Coffee made of clays and other like substances may be detected by the absence of pieces of the tegumentary structures, and by having no deep furrow on the face of the berry. Ground coffee has been adulterated with ground roasted dandelion root, besides the amylaceous bodies above mentioned. The husks of coffee-seed, which contain a considerable amount of the active constituent, have been sold as *sultan* or *sacca coffee.* The flavor of coffee is materially improved when it contains the seed pericarps. They should be distinguished from the fruit pericarp, which contains no caffeine.

Action, Medical Uses, and Dosage.—An infusion of roasted coffee is an agreeable stimulant, anti-soporific, and anti-emetic. It produces a mild, stimulating influence upon the organs of digestion, facilitating digestion, augmenting the biliary flow, and increasing peristalsis, thus favoring a free action from the bowels. It slightly accelerates the circulation; taken too freely, it impairs the nervous and digestive systems. The nervous symptoms are usually irritability, dejected spirits, weakness, trembling, watchfulness, mental confusion, headache, dizziness, and ringing noises in the ears; the gastric effects are flatulence, acidity, pyrosis, and bitter and sourish eructations, as well as disorders of the bowels. On the other hand, if one is accustomed to moderate amounts of the beverage, which aids digestion, headache will result if the coffee be withdrawn. Black coffee removes that drowsiness which is apt to follow a heavy dinner. A cup of strong coffee will cause a degree of wakefulness for several hours, and will frequently overcome the soporific or intoxicating effects of opium, morphine, or alcohol. In *delirium tremens* strong black coffee acts as a good and valuable hyposthenisant. In *poisoning from opium* it should always be given.

Prof. Lehman considers coffee to increase the activity of the vascular and nervous systems, while at the same time it retards the metamorphosis of plastic constituents; and which effects are owing chiefly to its empyreumatic, volatile oil. C. Voit, from more recent experiments, instituted by himself upon a dog, is led to infer that coffee rather increases the metamorphosis of nitrogenous tissue, and the excretion of urea, and attributes its principal effects to its action on the nervous system, and not to its influence on the tissue changes. The question as to whether coffee and its alkaloid hastens or retards tissue metamorphosis, is still a mooted one, but the preponderance of evidence is in favor of declaring it a restrainer of tissue changes, acting thereby as a conservator of force.

With regard to the influence of coffee upon the circulation, there is a discordance among authors, probably depending upon the quantity used, and the conditions under which it has been administered. In moderate quantity it increases the pulsations from 5 to 10 beats or more. M. Jomand, who experimented carefully upon himself, found it, in an elevated dose, to diminish the pulsations from 84 to 75. It moderates digestion, removing the sense of fullness and heaviness after meals; diminishes the sense of hunger, and powerfully aids in supporting abstinence. It lessens the amount of urea and phosphoric acid in the urine, as well as diminishes the quantity of carbonic acid gas, evacuated in the 24 hours, and has the power of retarding the disintegration of the constituents of the animal frame. It is an active diuretic, especially when its action is seconded by a white wine rich in carbonate of potassium. With some it regulates the bowels. It renders motility and exercise more energetic, and diminishes the sensation of fatigue. It produces wakefulness without being followed by fatigue, and influences the brain so that one acquires an unexpected facility for intellectual labor, conversation, etc. But when coffee is used in excess, or when only its bitter and other principles are employed, too long boiling having driven off its aroma, it proves decidedly injurious.

Some individuals, from the excessive amounts of coffee ingested, suffer from what may be aptly termed chronic coffee poisoning. The chief symptoms are a pallid or dusky skin with emaciation, dull, expressionless features, sometimes swollen, and again looking prematurely old. Dilated pupils and a glassy stare are observed, and both the tongue and lips tremble in talking. Sleeplessness or disturbed sleep supervenes, the appetite is poor, digestion is feeble, with diarrhœa or constipation; gastralgia and other neuralgic pains are felt in various parts of the body, and dizziness and headache, with occasional spasms or convulsions, are not uncommon results. It is not unlikely that many cases of pruritis ani et vulvæ are due to even moderate coffee drinking, and when the amount consumed is very large, these symptoms are more pronounced. To complete the picture, intractable leucorrhœal discharges debilitate the woman, while sexual vigor is impaired or impotence induced in the male.

Coffee, when burned in the rooms where noxious odors are present is well known as an efficient deodorizer, and is said to exert a feeble influence over pathogenic bacteria. When partially carbonized it may be used like charcoal, as a dressing for *gangrenous* and other foul *ulcers*. Internally, coffee has proved temporarily useful in light *nervous headaches*, especially *migraine*, and in *asthma*, *hysteria*, *obstinate chronic diarrhœa*, and *calculous nephritis*. It is contraindicated in all inflammatory affections of a high grade. Dr. A. Brown, of Cincinnati, found a strong decoction of the pulverized, unroasted coffee a superior remedy in some forms of *chlorosis* or *amenorrhœa*. When fullness in the head and pain in the back were present, he gave a gentle purgative, then used the warm foot-bath, and administered the decoction in wineglassful doses every half-hour or hour. Taken in early morning, coffee is a valuable adjunct in the treatment of *constipation;* on the other hand, in excess it may induce that condition. Either *constipation* or *diarrhœa* are corrected by it when these troubles depend upon gastro-intestinal atony. *Indigestion*, when dependent upon gastric atony, or when associated with exhaustion or debility, is benefited by pure black coffee in moderate amounts. It has long enjoyed a reputation of retarding tissue waste and conserving the vital forces, and when administered in this manner in *acute fevers* of a typhoid character, and in convalescence from acute disorders, the effects are salutary. In these conditions it is preferable to alcohol, for it is not followed by depression like the latter agent. The well known power of coffee *to sober drunken individuals* is often taken advantage of by inebriates, and in small and repeated doses it stimulates the stomach and nervous system, and retards tissue change, thus assisting in the treatment of *delirium tremens*, in which it also tends to overcome the anemic condition of the brain. Coffee, in strong infusion, without cream or sugar, is one of the first agents to be thought of in *opium narcosis*, though atropine should also be cautiously used, and electricity, and particularly flaggellation, resorted to; here the coffee should be given in small and frequently repeated amounts, and not in large quantities at a single dose. Both coffee and caffeine are efficient in *strychnine poisoning*. It is a valuable agent in *congestive headache*, but is asserted to aggravate where the patient is pale and the pain is simply neuralgic in character.

Coffee has also been used with much success in *whooping-cough*, *hiccough*, and in *spasmodic asthma*, in the form of syrup, made with the extract of coffee prepared without heat, or a strong infusion by percolation, given in small and repeated doses. Salter expresses his belief that two-thirds of the cases of *asthma* in which coffee is employed, are relieved by it. Dr. W. Hamilton considered the free use of strong coffee almost a specific for *gout*, *rheumatism*, and *gravel*. Its efficiency in the majority of cases of *rheumatism*, however, may be questioned. Bouchardat considered it useful in *malarial districts*, and stated that without it, the European colonists would have been unable to dwell in several parts of Algiers.

It has been observed by Dr. Mosely, in his *Treatise on Coffee*, that "the great use of coffee in France is supposed to have abated the prevalence of the *gravel*. In the French colonies, where coffee is more used than in the English, as well as in Turkey, where it is the principal beverage, not only the *gravel*, but the *gout*, those tormentors of so many of the human race, are scarcely known. Du Four relates, as an extraordinary instance of the effects of coffee in gout, the case of Mr. Deverau. He says this gentleman was attacked with the gout at 25 years of age, and had it severely until he was upward of 50, with chalk-stones in the joints of his hands and feet; but for 4 years preceding the account of his case being given to Du Four to lay before the public, he had been recommended the use of coffee, which he had adopted, and had no return of the gout afterward." But its efficacy is not confined to the cure or mitigation of these maladies. Sir John Floyer, who had suffered under *asthma* for more than 60 years, without finding any relief from any of the numerous remedies he tried, was at length cured, when above 80 years of age, by the free use of coffee.

Through their diuretic qualities both coffee and its alkaloid have attained some distinction as remedies for *dropsies of cardiac origin.* It is adapted to cases of *heart debility*, rather than to obstructive valvular lesions, and, according to Brakenridge, it acts upon (stimulates) the renal epithelium. The whole circulatory and muscular system is aroused by them, because the nervous power to cause them to act is augmented, and they become, therefore, of more value than digitalis, which only affects the involuntary muscular fibers, inducing tonic contractions. Caffeine possesses this power to a greater degree than coffee. It should be borne in mind, however, that both coffee and tea will accomplish therapeutical results, which their alkaloid is unable to fulfil (compare *Thea: Caffeina*).

S. Martin observes that the decoction of green coffee (unroasted), when it possesses all its caffeine, forms a liquid possessing stupifying properties; while roasted coffee furnishes an excitant fluid. Strong coffee has been used successfully to control *metrorrhagia* and *post partum hemorrhage.*

Specific Indications and Uses.—Spasmodic asthmatic seizures; opium narcosis; renal torpor; cardiac insufficiency; unpleasant sense of fullness in the head and drowsiness after meals; migraine, with cerebral hyperemia; constipation, from gastric atony, when not due to excessive use of coffee.

CAFFEINA (U. S. P.)—CAFFEINE.

FORMULA: $C_8H_{10}N_4O_2+H_2O$. MOLECULAR WEIGHT: 211.68.

"A feebly basic, proximate principle, obtained from the dried leaves of *Thea sinensis*, Linné (*Nat. Ord.*—Ternstrœmiaceæ, or from the dried seeds of *Coffea arabica*, Linné (*Nat. Ord.*—Rubiaceæ), and found also in other plants"—(*U. S. P.*).

SYNONYMS: *Theine, Coffeine, Caffeia, Guaranine, Methyl-theobromine, Trimethylxanthine.*

Preparation.—H. J. Versman states the following to be a very profitable and simple mode of obtaining caffeine. Ten parts of bruised coffee are mixed with 2 parts of caustic lime, previously slaked. This mixture is placed in an ordinary percolator, with alcohol of 80°, until the fluid which passes through no longer furnishes evidence of the presence of caffeine. The coffee is then roughly ground and brought nearly to the state of a powder, and the refuse of the already once digested mixture from the percolator dried, and ground again, and, mixed with hydroxide of calcium, is once more macerated. The grinding is more easily effected after the coffee has been subjected to the operation of the alcohol, having lost its horny quality, and the caffeine is thus certainly extracted. The clear alcoholic fluid thus obtained is then to be distilled, and the refuse in the retort to be washed with warm water to separate the oil. The resulting fluid is then evaporated until it forms a crystalline mass, which is to be placed on a thick filter, and the moisture expressed. The moisture, after evaporation, still furnishes some caffeine. The impure caffeine is freed from oil by pressure between folds of blotting paper, and purified by solution in water with animal charcoal, and then crystallized by evaporation. Good Brazilian coffee thus yielded 0.57 per cent of caffeine.

A former Hanoverian *Pharmacopœia* directed caffeine to be made by precipitating a decoction of coffee with acetate of lead, filtering and washing the precipitate, evaporating the liquids to dryness, and, after mixing the powdered extract with sand, the mass is sublimed in Mohr's apparatus, just as in making benzoic acid (*A. J. P.*).

With a view of extracting all the caffeine from coffee, M. Pucetti tried the following method: He brought the decoction of coffee to the consistence of an extract, and treated it with alcohol, which left undissolved a resinous substance; he then dissolved a slight excess of pulverized caustic lime in the alcoholic fluid, which, when filtered and evaporated to the necessary degree, furnished crystals of impure caffeine. This was pressed between thick linen, to get rid of the adherent mother liquor, and then dissolved in well-water, and treated with animal charcoal, by which means the alkaloid was obtained pure. One pound of coffee yielded $\frac{1}{20}$ of an ounce (about 1.5 gramme) of caffeine. He also obtained it in larger quantity from tea.

Vogel's process for procuring caffeine is to treat ground coffee with benzin; this dissolves out the caffeine and fixed oil. Distill the benzin solution to dryness, and boil the residue in water, which dissolves the caffeine, and deposits it on filtering and concentrating the liquid.

Wayne's method is to boil finely ground coffee or tea (2 parts) in washed litharge (3 parts) and water. On filtering, an almost colorless filtrate is obtained, which, by means of sulphide of hydrogen, is freed from lead, and, when sufficiently concentrated, yields caffeine in colorless crystals. Some of the alkaloid still remains in the mother liquor, and, after treatment with bone charcoal, colorless crystals may again be obtained. Another common method is that of Garot: Precipitate a coffee decoction with acetate of lead; filter; treat the filtrate with sulphide of hydrogen, to remove the lead in excess; add ammonia to neutralization; evaporate and recrystallize.

Description and Tests.—According to the *U. S. P.* caffeine occurs as "fleecy masses of long, flexible, white crystals, possessing a silky lustre, without odor, having a bitter taste, and permanent in the air. Soluble, at 15° C. (59° F.), in 80 parts of water, 33 parts of alcohol, 555 parts of ether, or 7 parts of chloroform. Also soluble in 9.5 parts of boiling water, and very soluble in boiling alcohol. When heated to 100° C. (212° F.), caffeine loses its water of crystallization, and at 229° C. (444.2° F.) it melts, forming a colorless liquid. When ignited, caffeine is completely volatilized without charring or leaving a residue. Caffeine is neutral to litmus paper. On dissolving a small quantity of caffeine in concentrated sulphuric acid, and adding a minute fragment of potassium dichromate to the liquid, the latter will acquire a yellowish-green color, which gradually becomes green. If a small quantity of caffeine be dissolved in about 1 Cc. of hydrochloric acid, a little potassium chlorate added, the whole evaporated to dryness on a water-bath, and the capsule then inverted over a vessel containing a few drops of ammonia water, the residue will acquire a rich purple color, which is destroyed by alkalies. Caffeine should dissolve in strong sulphuric or nitric acid without producing a color (absence of organic impurities). Its aqueous solution should not be precipitated by mercuric potassium iodide T.S. (absence of other alkaloids)"—(*U. S. P.*). At an elevated temperature it sublimes in needles similar to those of benzoic acid. Tannic acid precipitates it from aqueous solution. According to the analysis of theine from tea by M. Jobst, caffeine proves to be identical with it. Caffeine exists in other substances, as tea (containing 2 to 4 per cent), maté (Paraguay tea), kola nut, guarana, etc. (in the latter to the extent of 5 per cent). The taste of caffeine, though bitter, is not very unpleasant. The alkaloid may be obtained in an anhydrous state by crystallization from ether or alcohol; but, if crystallized from water, it contains a molecule of H_2O, which is expelled at, or above the boiling point of water (100° C. [212° F.]).

Chemical Composition.—It has been shown by Strecker, who produced it synthetically (1861), that caffeine is *methyl-theobromine*. When heated in the presence of barium hydroxide solution, or with solution of caustic potash in alcohol, beside a barium or potassium salt, ammonia and methylamine are produced, and from the residual matter may be obtained an amorphous basic body, soluble in both alcohol and water, but very sparingly soluble in ether, and which is known as *caffeidine* ($C_7H_{12}N_4O$). By prolonged heating the caffeidine is further decomposed and results in the production of formic acid, methylamine, ammonia, and sarkosine (methylglycocoll [$NHCH_3.CH_2.COOH$]). J. E. Walter (*Pharm. Rec.*, 1890), from an analysis of several kinds of unroasted coffee berries, found Costa Rica coffee to contain the largest amount of caffeine (1.24 per cent), and Mocha the least (0.54 per cent); other grades were: Rio, 1.12; Liberian Java, 1.08; Java, 0.89; Peaberry (Fenroll), 0.77 (also compare *Caffea*).

Action, Medical Uses, and Dosage.—To the nervous system caffeine is stimulant, its effects being rapidly developed. It produces a characteristic wakefulness, and a state of nervous unrest. Mental activity is pronounced, thought is rapid, and so great is the cerebral stimulation, that an enormous amount of brain power is developed, so that individuals are capable of prolonged and severe mental application. The reasoning faculties are sharpened, and there is also a marked capacity for physical labor. There is a great variability in its effects, as much as 23 grains having been given without marked toxicity, while doses of 8 or 9 grains have induced symptoms quite like those from alcoholic intoxication—giddiness, tinnitus, headache, tremors, unrest, wakefulness, mental confusion, delirium, and a state of drowsiness being among the phenomena observed. Diuresis is also increased. It seems not to affect the blood, though readily absorbed. Varying reports are given of its effects upon the heart. The cardiac contractions, however, are increased in force, the systole being sustained while the diastole is shortened. In consequence, there is a rise in the blood pressure. It is not thought, as formerly, that caffeine acts directly upon the cardiac muscles, like digitalis, but that it stimulates the nervous centers, thus striking at the source of cardiac power. Under its action the regularity of the heart-action is restored when disordered; the pulse rate is increased, and blood pressure augmented. These are the effects of medicinal doses, while in large amounts the heart is paralyzed by caffeine and its salts. Small doses scarcely affect the temperature, which is somewhat increased by large doses. Large doses also depress the breathing organs, while, in therapeutic doses, it acts upon the medulla, causing mere respiratory excitation. Upon the muscular structures its action is decided, increasing the power of contractility. Caffeine acts upon the secreting cells of the kidneys, stimulating them and causing diuresis—a function greatly augmented by overdoses of the drug. Both the liquid and solid constituents of the urine are increased by it, thus proving it one of the best diuretics. Partial elimination takes place by the kidneys, chiefly when toxic amounts are ingested, but in therapeutic doses the drug is destroyed in the system. That both coffee and caffeine enables one to stand severe mental and physical service is well known, and, though a question still in dispute, it is believed that this is due to its power of limiting the excretion of nitrogenous products, thus acting as a restrainer of tissue waste—a conservator of both tissue and force. This was pointed out by Lehmann (1853) and Böcker (1854) the former showing that, after the administration of a daily quantity of 6 grains of caffeine, the elimination of urea diminished from 12 to 20 per cent. Citrated caffeine, in a dose of 18 grains, caused in a woman of 30, delirium, semi-insensibility, but no headache. The feet, hands and tongue trembled, and the patient walked with a reeling gait. A cold and clammy perspiration covered the surface and the extremities were cold; the temperature remained unaffected, but the pulse was irregular and slow (55); the legs cramped; the hands and feet were slightly paralyzed; and tetanoid convulsions ensued, as well as vomiting. Intestinal pain added to the unpleasantness, but no action from the bowels was provoked. The vision was dulled though the pupils were unaffected. As is characteristic of the drug, free and frequent urination took place. In another instance an experimenter (Dr. Pratt) experienced, from 12 grains of caffeine, great mental anxiety and restlessness, persistent and rapid thinking, tremors, obstinate insomnia, and urination was frequent. These effects were developed in 2 hours after taking the drug.

Caffeine may be used to fulfil many of the uses for which coffee itself is used. It should be remembered, however, that neither fully represents the other, their effects being somewhat different, and, indeed, it is very doubtful if much caffeine remains in coffee which has been subjected to heat. The chief uses for caffeine are as a cardiac and cerebral stimulant, and as a remedy for *dropsy of cardiac origin*. As opium and coffee, and morphine and caffeine, are directly antagonistic to each other, it seems a plausible remedy for *opium narcosis*, and coffee has for years occupied the place of a standard remedy for this condition. Other and more active treatment should be instituted at the same time. Caffeine and its salts are among the most powerful of heart energizers, and may be thought in feeble and irregular action of that organ, when not due to obstruction or valvular lesions. It is preferable to digitalis in that it does not derange the stomach, is not cumulative, and acts primarily upon the nerve centers, presiding over the cardiac movements and not like digitalis upon the heart muscle alone.

Cardiac paralysis, or *heart failure*, may be averted by administering 5 grains every 2 hours. It is particularly adapted to that failure of cardiac power depending upon *heart dilatation*, *typhoid fever*, *pneumonia*, *la grippe*, and other diseases tending to implicate the heart. Administer 2 grains every 2 or 3 hours. It is more prompt than digitalis and yet more fugacious, though its diuretic power is greater. It is a valuable remedy in *dropsy*, due to feeble and irregular cardiac action, and will even act independently of its effects upon the circulation, as it has been shown to directly affect the secretory epithelial structures of the uriniferous tubules. Other forms of dropsy than the cardiac variety are little benefited by it. While it should be avoided in *acute albuminuria*, it is of signal value in the chronic form, with weak heart, provided no marked irritation of the kidneys be present. It corrects the deficient action of the renal structures. It is not without value in *uremic coma*. Caffeine, or the citrate, may be given in doses of from 1 to 5 grains every 4 hours, increasing the dose as necessary. If it tends to produce obstinate wakefulness at night, the doses may be given at short intervals in the early part of the day. It is of value in the *pulmonary congestion* and *pneumonia* of the aged, assisting both the heart-action and the pulmonic circulation.

Caffeine, and especially the citrated form, has attained a reputation in *migraine*. The cases most benefited are those of a hyperemic character with flushed countenance and cerebral fullness. Purely neuralgic pain, with cerebral anemia, is said to be made worse by caffeine.

The dose of caffeine ranges from ½ to 9 grains, mixed with sugar, though the intermediate doses are to be preferred. Sodium benzoate, sodium salicylate, and antipyrin render it more soluble, and it should not be given in pill. Tanret's solution for hypodermatic use consists of sodium benzoate, Gm. 3.60 (55.5 grains); caffeine, Gm. 3 (46.3 grains); and distilled water, q. s. 10 Cc. (162.3 minims). Each cubic centimeter contains Gm. 0.30, or about 5 grains of caffeine.

Specific Indications and Uses.—Cardiac insufficiency; renal torpor, depending upon a weak heart, and dropsy from a like cause. Headache (migraine), with cerebral hyperemia, as evidenced by flushed face; hyperemic states of the cerebrum; opium narcosis.

Derivative of Caffeine.—ETHOXY-CAFFEINE.—This product has a somewhat narcotic effect upon both the brain and the spinal cord. Without materially interfering with the motor centers, or the circulation, it may cause stupor and paralysis. Diuresis, diaphoresis, and quickened heart-action, with flushed countenance, result from its physiological doses. Moderate doses induce sleep, while larger doses seem to disturb it. It may produce vomiting. In broken doses it may be administered to the extent of from 4 to 12 grains daily for the relief of *migraine*.

CAFFEINA CITRATA (U. S. P.)—CITRATED CAFFEINE.

SYNONYM: *Caffeine citrate.*

Preparation.—"Caffeine, fifty grammes, (50 Gm.) [1 oz. av., 334 grs.]; citric acid, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; distilled water (hot) one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Dissolve the citric acid in the hot distilled water, add the caffeine, and evaporate the resulting solution, on a water-bath, to dryness, constantly stirring towards the end of the operation. Reduce the product to a fine powder, and transfer it to well-closed bottles"—(*U. S. P.*).

Commercial citrate of caffeine, so-called, is not a definite salt, but as the pharmacopœial name (citrated caffeine) would indicate, it is the alkaloid caffeine, with a portion of adherent citric acid, as shown by Hager and Haarmann. While the process above given produces a citrated caffeine only, Prof. J. U. Lloyd has shown that a true citrate of caffeine may be obtained by dissolving caffeine in chloroform and citric acid in alcohol, and mixing the two solutions, when, by evaporation, crystals of caffeine citrate result. He has further shown that this salt, so obtained, decomposes immediately in contact with water. (See *New Remedies*, 1881, p. 38).

Description.—"A white powder, odorless, having a purely acid taste and an acid reaction. One part of citrated caffeine forms a clear, syrupy solution, with about 3 parts of water. Upon dilution with water, this yields a white precipitate (caffeine), which redissolves when about 25 parts of water have been added.

It is also soluble in a mixture of 2 volumes of chloroform and 1 volume of alcohol"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—The general action and uses of this drug are the same as those given under caffeine. This salt is used chiefly as a remedy for the *idiopathic headache*, called *migraine* (pain in the forehead). This salt is very soluble in water, and is assimilated much more readily than pure caffeine when taken into the stomach. It may be made into a pill mass with some simple extract, say 8 grains of the salt to 15 of the extract, and divided into 10 pills, of which 1 may be given every 1 or 2 hours. Pills, however, are not as desirable as other forms for administration. Or, 2½ drachms of the salt may be dissolved in 4 ounces of simple syrup, of which 1 tablespoonful may be given as above, according to the violence of the attack. The dose of citrated caffeine ranges from 3 to 8 grains (see *Caffeina* for *Uses and Specific Indications*).

Related Salts of Caffeine.—VALERIANATE OF CAFFEINE. Like the citrated caffeine, this is not a definite product, and is liable to great variability in strength and quality. It has been employed in ⅓ to ½-grain doses, administered twice daily, for the relief of *pertussis*. It is asserted to be useful in allaying the *vomiting of hysteria*.

CAFFEINE DIIODIDE-HYDRO-IODIDE ($2C_8H_{10}N_4O_2I_2HI+3H_2O$), or so-called *caffeine triiodide*, occurs as long prismatic crystals, of a deep-green color. It is freely dissolved by alcohol. Dose, 1 to 4 grains.

CAFFEINÆ SODIO-BENZOAS (N.F.), *Caffeine sodio-benzoate.—Formulary number*, 15: "Caffeine, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; sodium benzoate, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; alcohol, a sufficient quantity. Triturate the caffeine with the sodium benzoate and a sufficient quantity of alcohol, to a smooth paste, and dry this by exposure in a moderately warm place. Rub the dry mass to a powder, and keep in well-stoppered bottles. *Note.*—The product contains 50 per cent of caffeine, and is soluble in 2 parts of water"—(*Nat. Form.*).

CAFFEINÆ SODIO-SALICYLAS (N. F.), *Caffeine sodio-salicylate.—Formulary number*, 16: "Caffeine, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; sodium salicylate, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; alcohol, a sufficient quantity. Triturate the caffeine with the sodium salicylate and a sufficient quantity of alcohol, to a smooth paste, and dry this by exposure in a moderately warm place. Rub the dry mass to powder, and keep it in well-stoppered bottles. *Note.*—The product contains 50 per cent of caffeine, and is soluble in 2 parts of water"—(*Nat. Form.*).

CAFFEINA CITRATA EFFERVESCENS (U. S. P.)—EFFERVESCENT CITRATED CAFFEINE.

Preparation.—"Caffeine, ten grammes (10 Gm.) [154 grs.]; citric acid, ten grammes (10 Gm.) [154 grs.]; sodium bicarbonate, three hundred and thirty grammes (330 Gm.) [11 ozs. av., 280 grs.]; tartaric acid, three hundred grammes (300 Gm.) [10 ozs. av., 255 grs.]; sugar, in very fine powder, three hundred and fifty grammes (350 Gm.) [12 ozs. av., 151 grs.]; alcohol, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Triturate the solid ingredients, separately well dried, to a fine uniform powder. Mix this with alcohol, to a soft paste, and rub it through a No. 6 tinned iron sieve or enamelled colander. Then dry it, and reduce it to a coarse, granular powder. Keep the product in well-stoppered bottles"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—An agreeable form in which to administer citrated caffeine, the dose being a teaspoonful dissolved in water, and drunk while effervescing (see *Caffeina*).

CAHINCA.—CAHINCA-ROOT.

The bark of the root of *Chiococca racemosa*, Jacquin.

Nat. Ord.—Rubiaceæ.

COMMON NAMES: *Snowberry*, *Cluster-flowered snowberry*, *Cahinca*, *Cainca*, *David's root*.

Botanical Source.—A somewhat climbing shrub, with a round, branched root, and a stem 8 to 12 feet high, arborescent, with branches opposite. The leaves are ovate, pointed, and smooth, with an uninterrupted margin; the stipules are short, pointed, and joined together at the base. The flowers are white, without odor, but subsequently become yellowish and redolent, and are borne in short, axillary, 1-sided racemes. The calyx is 5-cleft; the corolla funnel-shaped; the stamens 5. The fruit is a small, roundish, compressed, white berry. The *C. anguifuga*, Martius, and *C. densifolia*, Martius, are varieties possessing similar properties.

History and Description.—This plant, sometimes called *Snowberry*, is a native of the West Indies, South America, and also of the sea-coast of Florida. In Brazil the root is known as "*raiz pretta*" (black root). In that country the roots of *Chiococca anguifuga*, Martius, and *Chiococca densifolia*, Martius, are employed under the names *cainana* and *caninana*. The root as found in commerce, is in small round pieces of different sizes and lengths, flexuous, with longitudinal rugæ and a few rough spots, and brownish-black or grayish-brown, having its thin, cortical portion of a reddish-brown color, fragile, of a disagreeable odor, and a coffee-like taste, succeeded by a pungent nauseousness; its internal, woody portion is without taste. The bark is the medicinal part, and yields its properties to water or alcohol.

Chemical Composition.—Besides *cahincic acid* ($C_{40}H_{64}O_{18}$), the root-bark contains, according to Pelletier, gummy, oily, and coloring matters, the nature of which is not well understood. Its most important medicinal constituent is the *cahincic acid*, or *cahincin*. It forms in silky-white, acicular crystals, sparingly soluble in ether and cold water (1 in about 600). It dissolves in hot alcohol, from which it again crystallizes upon cooling. It is a permanent body, and is supposed to exist partly free in the root, and also as a calcium subcahincate. It is odorless, and has a slowly developing, yet excessively bitter taste. By boiling with hydrochloric acid it is split into grape sugar and other bodies, chief among which is *cahincetin* (*caïncetin*) ($C_{22}H_{34}O_3$), a principle soluble in alcohol, in which on adding water, it gelatinizes. The root contains a tannin which was pointed out, in 1851, by Rochleder and Hlasiwetz, to be *caffeo-tannic acid*. A body, named *cahincigenin*, having the formula $C_{14}H_{24}O_2$, and butyric acid, are produced when *cahincetin* and caustic potash are melted together.

Action, Medical Uses, and Dosage.—In medium doses it augments the urinary discharge, slightly accelerates the action of the heart, and increases the peristaltic action of the bowels; and if the body be kept warm, and warm infusions be drank, instead of purging it will produce perspiration. In large doses it produces the most violent emetic and drastic effects. It has been found efficient in *dropsy*, uncomplicated with acute renal disorder, *amenorrhœa*, *rheumatism*, *syphilis*, and *osteocopus*, and in Brazil is used as an antidote to *poisonous snakebites*. From 20 to 60 grains of the powdered root-bark will act as a purgative and diuretic; or from 10 to 20 grains of an aqueous or spirituous extract. It may also be used in decoction or tincture (root, ℥viii to alcohol 98 per cent, Oj). Tincture, 1 to 5 drops.

Specific Indications and Uses.—Scanty urine with a sense of fullness in the loins; edematous feet and eyelids.

CALAMUS (U. S. P.)—SWEET FLAG.

The rhizome of the *Acorus Calamus*, Linné.

Nat. Ord.—Aroideæ.

COMMON NAMES: *Sweet flag*, *Calamus.*

ILLUSTRATIONS: Willdenow, *Sp. Plants*, II., 199; Woodville, *Med. Bot.*, 248; Barton, *Med. Bot.*, II, 63; Bentley and Trimen, *Med. Plants*, 279.

Botanical Source.—Calamus is an herbaceous, perennial, aromatic, flag-like plant, flourishing in wet situations. The leaves are long, radical, and sword-like, erect, bright green, but reddish or pink at the base, where they are ensheathing. The stalk is triangular, giving off from one side a spadix bearing thickly crowded, perfect greenish-yellow flowers.

History.—Calamus grows in muddy places, in swamps and meadows, along streams and the borders of lakes, in nearly all parts of India and Central Asia (from whence it has spread to other parts of the globe), Southern Siberia, Japan, China, Europe, and North America. In Ceylon and Burmah it is cultivated to some extent. Persian and East Indian calamus is said to be of better quality than that of other parts of the world. In America it blooms from April to July. The rhizome should be gathered in early spring or in October and November, freed from dirt and its bitter rootlets, and dried quickly in a gently warmed room. The leaves also possess the aromatic properties of the rhizome, but to a lesser degree, and are not employed as a medicine. This drug and the calamus of Scripture are probably identical. Sweet flag has long been a popular remedy in India, where large quantities of it are yearly sold in the bazaars. According to Ainslie (1813), it is there considered so valuable in the bowel disorders of children that a penalty is incurred by any pharmacist who will not open his shop in the night to sell it when called upon to do so (*Pharmacographia*). The Hindus regard it as an emetic in large, and stimulant, tonic, and carminative in small doses, and employ it in stimulant doses in paralysis and other nervous disorders. The Mahometans use it internally in calculous troubles, and advise its use for teething children to bite upon. An infusion is considered in Ceylon as an efficient anthelmintic for children (Dr. Ondaatji, Col. Surg. of Ceylon). Evers found the decoction useful in diarrhœa and dysentery, and infantile bronchitis, and often used it personally for cold in the chest. Watts states that it is useful for distressing cough (Dymock, *Mat. Med. Western India*).

Description.—The rhizome, or part employed, is subspherical, creeping, fleshy, thick, and rather spongy, and gives off numerous rootlets. It is often several feet in length, and shows upon its upper surface triangular leaf-scars, which are occasionally apparently hairy (when dried), and on the lower surface may be seen several zigzag or wavy lines composed of circular dots, indicating where the rootlets were attached. The rhizome is occasionally wrinkled longitudinally, and has a brownish-yellow color (pinkish shortly after being peeled). It has a peculiarly agreeable, aromatic odor, and an aromatic, bitterish, pungent taste. The dried roots of commerce are from 3 to 6 inches long, light-brown or fawn colored, of a whitish or slightly roseate hue internally, corrugated outside, and break with a spongy or cork-like fracture. It has the peculiar warm, pungent taste possessed by the green rhizome. It loses its strength with age, and is liable to destruction by worms. Water or alcohol takes up its medicinal virtues. To preserve it, it should not be peeled. The *U. S. P.* describes it as follows:

"In sections of various lengths, unpeeled, about 2 Cm. (¾ inch) broad, subcylindrical, longitudinally wrinkled; on the upper surface marked with leaf-scars forming triangles, and on the lower surface with the circular scars of the rootlets in wavy lines; externally reddish-brown, somewhat annulate from remnants of leaf-sheaths; internally whitish, of a spongy texture, breaking with a short, corky fracture, showing numerous oil cells and scattered wood bundles, the latter crowded within the subcircular endoderm. It has an aromatic odor, and a strongly bitter taste"—(*U. S. P.*).

Chemical Composition.—Trommsdorff found it to contain essential oil, resin, extractive with chloride of potassium, gum with phosphate of potassium, starchy matter, woody fiber, and water. The oil is lighter than water, and is pale yellow, very odorous and pungent. Kurbatow (1873) found this oil to contain a hydrocarbon ($C_{10}H_{16}$), which, with hydrochloric acid, formed a crystalline compound, and another hydrocarbon refusing to combine with this acid (*Pharmacographia*). Faust (1867) obtained a bitter glucosid, of a brownish color, and of a semi-fluid consistence, which he named *acorin* ($C_{36}H_{60}O_6$). It contains no nitrogen when purified, is insoluble in water and benzol, but dissolves in alcohol, methylic alcohol, chloroform, and ether. Flückiger (*Pharmacographia*), by precipitating a decoction with tannin, and treating the precipitate with litharge, and exhausting the residue with chloroform, obtained a minute quantity of a very bitter, crystalline solid. Thoms (1886) thought to have obtained a crystalline alkaloid, *calamine*, which, however, in 1888 he declared to be *trimethylamine*. This result is supported by the observation of Kunz (1888) who found *choline* to exist in calamus root.

Action, Medical Uses, and Dosage.—The root is carminative, slightly tonic, and excitant, and forms a useful adjunct to other tonics and stimulants. It may be used in cases of *flatulent colic*, *atonic dyspepsia*, *feebleness of the digestive organs*, and to aid the action of cinchona or quinine in *intermittents*. It forms an excellent substitute, in syrup, for Godfrey's cordial. In *flatulent colic* of infants it is best combined with magnesia. Externally, it is a valuable application to *indolent ulcers*, and to keep up the discharges from *blistered surfaces* and *issues*. Dose of the infusion made by scalding 4 drachms of the root, coarsely bruised, in 8 fluid ounces of water, from 4 to 6 fluid ounces; of the powdered root, 20 to 40 grains; a tincture may be prepared from 1 part of the root and 5 parts of alcohol. Dose, from 5 to 30 minims.

CALCII BROMIDUM (U. S. P.)—CALCIUM BROMIDE.

FORMULA: $CaBr_2$. MOLECULAR WEIGHT: 199.43.

SYNONYM: *Bromide of calcium.*

Preparation.—This salt may be formed by the decomposition of bromide of sulphur with lime. In 1872, Mr. J. R. Mercein recommended that it be prepared from hydrobromic acid and carbonate of calcium, hydrobromic acid being first made by passing sulphide of hydrogen through bromine beneath water, and then the carbonate of calcium to be subsequently decomposed with this solution. To this end, take any convenient quantity of solution of hydrobromic acid, place it in a porcelain evaporating dish capable of holding 4 times the bulk, and then add carbonate of calcium, with stirring, as long as effervescence continues, then warm it, filter, and evaporate the filtrate to dryness.

Description.—Bromide of calcium, by evaporation from its aqueous solution, forms silky needles which, according to Watts, are a hydrated bromide. In many respects it resembles calcium iodide and calcium chloride. The *U. S. P.* describes it as "a white, granular salt, odorless, of a sharp, saline taste, and very deliquescent. Soluble at 15° C. (59° F.), in 0.7 part of water, and in 1 part of alcohol; much more soluble at a boiling temperature. At 680° C. (1256° F.), the salt fuses, and at a higher temperature it is partly decomposed, with loss of bromine. The salt is neutral to litmus paper"—(*U. S. P.*).

The impurities more apt to be encountered in this salt are hydroxide of calcium and calcium oxybromide (calcium bromate). Either may be separated by dissolving the salt in alcohol, and then filtering, as these impurities are insoluble in alcohol. Other substances, such as chlorides, nitrates, bromates, etc., are not likely to occur in any considerable amount. "Calcium bromide should be kept in well-stoppered bottles"—(*U. S. P.*).

Tests.—"The aqueous solution (1 in 20) of the salt yields, with ammonium oxalate T.S., a white precipitate insoluble in acetic acid, but soluble in hydrochloric acid. If to 5 Cc. of the aqueous solution a few drops of chloroform be added, and then 1 Cc. of chlorine water, bromine will be liberated, and, on agitating the mixture, will dissolve in the chloroform with a yellow or brownish-yellow color. If 1 Gm. of the salt be dissolved in 20 Cc. of the water, it should form a clear, colorless solution, leaving no residue (absence of insoluble impurities). If to 5 Cc. of this aqueous solution, slightly acidulated with hydrochloric acid, an equal volume of hydrogen sulphide T.S. be added, neither coloration nor turbidity should be perceptible (absence of arsenic, lead, etc.). The addition of ammonium sulphide T.S. to the aqueous solution should not produce any color or turbidity (absence of iron, aluminum, etc.). If 5 Cc. of the aqueous solution (1 in 20), slightly acidulated with acetic acid, be completely precipitated with ammonium oxalate T.S., the filtrate should, on evaporation, leave not more than a trace of fixed residue (limit of magnesium and alkalies). If diluted sulphuric acid be dropped upon the salt, the latter should not at once assume a yellow color (absence of bromate). If to 5 Cc. of the aqueous solution (1 in 20) a few drops of starch T.S. be added, and then chlorine water, drop by drop, no blue color should appear (absence of iodide). No turbidity should be produced if 0.2 Cc. of barium chloride T.S. be added to 5 Cc. of the aqueous solution (absence of sulphate). If 1 Gm. of the salt be mixed with 0.5 Gm. of iron filings and 0.5 Gm. of powdered zinc, and heated in a test tube with 5 Cc. of sodium hydrate T.S., no ammoniacal vapors should be evolved (absence of nitrate or nitrite). If 0.25 Gm. of the well-dried salt be dissolved in 10 Cc. of water, and 2 drops of potassium chromate T.S. added, it should require 25 Cc. of decinormal silver nitrate V.S. to produce a permanent red color (corresponding to 99.7 per cent of the pure salt, a greater amount indicating presence of chloride, a smaller amount other impurities"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—The attention of the profession was directed to bromide of calcium, in 1871, by Dr. W. A. Hammond, as a sedative and hypnotic in certain nervous maladies, in lieu of bromide of potassium and other bromides. He has found it beneficial, acting promptly, in cases of *delirium*, *insomnia* due to business anxieties, or intense mental labor or excitement; in exhausted and irritable conditions of the nervous system, as indicated by *headache*, *vertigo*, *wakefulness*, etc., so frequently observed among hysterical women; in *epilepsy* occurring in very young infants, that resisted the bromide of potassium. He has likewise derived advantage from its use in *cerebral congestion*, both the active and passive forms, and in *locomotor ataxia*. It is much more prompt in its action than the other bromides. Its dose is from 15 to 30 or more grains for an adult. He has given the following as an eligible formula: Take of bromide of calcium 1 ounce, syrup of lactophosphate of calcium 4 fluid ounces; mix. The dose of this solution is 1 teaspoonful in a little water, to be repeated 3 times a day. This bromide will be found useful in nearly all cases in which the other alkaline bromides are indicated, in most instances acting more promptly, with greater efficiency, and with less tendency to acneiform eruptions.

Specific Indications and Uses.—Anemia; nervous debility from malnutrition.

CALCII CARBONAS PRÆCIPITATUS (U. S. P.)—PRECIPITATED CALCIUM CARBONATE.

FORMULA: $CaCO_3$. MOLECULAR WEIGHT: 99.76.

SYNONYMS: *Calcaria carbonica præcipitata*, *Creta præcipitata*, *Precipitated carbonate of calcium*, *Precipitated chalk* (compare *Creta præparata*).

Preparation—Precipitated chalk may be made by dissolving 5 ounces of chloride of calcium (obtained by dissolving pieces of marble in diluted hydrochloric acid, leaving the former in excess), and 13 ounces of carbonate of sodium, each, in 2 pints of boiling distilled water, mixing the two solutions, and when the precipitate has subsided, collecting it on a calico filter, washing it with boiling distilled water, until the washings cease to give a precipitate with nitrate of silver, and then drying the product at a temperature of 100° C. (212° F.), or on bibulous paper. It forms a very pure article. This process is in accordance with that of the *British Pharmacopœia*. The reaction may be expressed thus: $CaCl_2+Na_2CO_3=CaCO_3+2NaCl$. The calcium carbonate is precipitated while the sodium chloride is left in solution, though the precipitated salt, even when repeatedly washed, is apt to retain a small amount of common salt. If precipitated in cold instead of hot water, the product is a light and bulky, flocculent article, difficult to deprive of its impurities, even by thorough washing. Other alkaline carbonates produce with soluble calcium salts, a precipitated carbonate of calcium. When ammonium carbonate is employed, the product is deprived of its impurities with less difficulty than when sal soda is used. It is sometimes adulterated with calcium sulphate (gypsum).

Description and Tests.—"A fine, white powder, without odor or taste, and permanent in the air. Nearly insoluble in water; the solubility is increased by the presence of ammonium salts, and especially by carbonic acid; alkali hydrates diminish it. Insoluble in alcohol. In diluted acetic, hydrochloric, or nitric acid, it is completely soluble, with effervescence. When heated to redness with access of air, the salt loses carbon dioxide, and a residue of calcium oxide remains"—(*U. S. P.*).

"For applying tests of identity and of purity, boil 6 Gm. of calcium carbonate with a mixture of 50 Cc. of diluted acetic acid, and 50 Cc. of water, allowing the liquid to cool, and filter. In this solution, ammonium oxalate T.S. produces a white precipitate insoluble in acetic acid, but soluble in hydrochloric acid. If from 20 Cc. of this solution the calcium be completely precipitated by a slight excess of ammonium oxalate T.S., the filtrate should, on evaporation, leave only a trace of fixed residue (limit of magnesium and alkalies). If 10 Cc. of the solution be slightly acidulated with acetic acid, no immediate turbidity should be produced by the addition of 0.5 Cc. of barium chloride T.S. (limit of sulphate).

If to 10 Cc. of the solution, slightly acidulated with nitric acid, 0.1 Cc. of silver nitrate V.S. be added, and the precipitate, if any, removed by filtration, the filtrate should remain perfectly clear upon the addition of more silver nitrate V.S. (limit of chloride). Addition of ammonia water should not produce any turbidity in the solution (absence of iron, aluminum, phosphate, etc.). If to the solution, slightly acidulated with acetic acid, an equal volume of hydrogen sulphide T.S. be added, neither color nor turbidity should be produced (absence of arsenic, lead, etc.). If 1 Gm. of the salt be agitated with 50 Cc. of water, the filtrate should not show an alkaline reaction with litmus paper, and, on evaporation, should not leave more than a trace of residue (limit of soluble impurities)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—For general uses precipitated chalk does not possess any marked advantage over prepared chalk, though some dentists prefer it to the latter as a dentifrice. On the other hand, the amorphous creta præparata is to be preferred for internal use (see *Creta Præparata*). The dose of precipitated chalk is the same as for prepared chalk.

CALCII CHLORIDUM (U. S. P.)—CALCIUM CHLORIDE.

FORMULA: $CaCl_2$. MOLECULAR WEIGHT: 110.65.

"Calcium chloride, rendered anhydrous by fusion at the lowest possible temperature. It should be kept in well-stoppered bottles"—(*U. S. P.*).

SYNONYMS: *Calcium chloratum*, *Chloridum calcicum*, *Calcaria muriatica*.

Source and Preparation.—Calcium chloride is present in sea-water and in the waters of many mineral springs. It is obtained largely as a by-product in the production of potassium chlorate and ammonia water. When the latter is made by double decomposition of ammonium chloride and calcium hydroxide, calcium chloride results, thus: $(NH_4Cl)_2+Ca(OH)_2=CaCl_2+(NH_4OH)_2$. It may be prepared by dissolving fragments of chalk, marble, or other forms of calcium carbonate, in hydrochloric acid, allowing chlorine gas to pass into the solution to oxidize the iron and manganese, then adding an excess of milk of lime, filtering, and finally evaporating the filtrate to dryness over a fire.

The commercial form is unsuited for chemical uses, such as drying gases, etc. It may, however, be rendered useful for this purpose by fusing in a porcelain or iron evaporating dish over a direct fire, and allowing it to become dry, and, while still hot, transferring to and securing it in glass-stoppered bottles.

Description and Tests.—Calcium chloride may be obtained as transparent, colorless, deliquescent, striated, prismatic crystals, having the composition: $CaCl_2+6H_2O$; but as met with in commerce it is in amorphous masses or lumps. On account of its remarkable affinity for water, it is used in the laboratory for abstracting moisture from gases. The Pharmacopœial salt is thus described: "White, slightly translucent, hard fragments, odorless, having a sharp, saline taste, and very deliquescent. Soluble, at 15° C. (59° F.), in 1.5 parts of water, and in 8 parts of alcohol, in 1.5 parts of boiling alcohol, and very freely in boiling water; insoluble in ether. Below a red heat the salt fuses, and, on cooling, solidifies without change in composition; but at a higher temperature, especially if kept in fusion for some time, a portion is decomposed and calcium oxide formed. When perfectly pure, the salt dissolves in water without residue, and the solution is strictly neutral to litmus paper. When the salt is overheated in fusing, the solution has an alkaline reaction, and a small residue is left, which is soluble in hydrochloric acid. The aqueous solution (1 in 20) yields, with ammonium oxalate T.S., a white precipitate, insoluble in acetic acid, but soluble in hydrochloric acid. With silver nitrate T.S. it yields a white precipitate insoluble in nitric acid. The aqueous solution (1 in 20) should remain clear upon addition of ammonia water (absence of iron, aluminum, etc.), or of barium chloride T.S. (absence of sulphate). If from 20 Cc. of the solution the calcium be completely precipitated by ammonium oxalate T.S., the filtrate should, on evaporation, leave not more than a trace of fixed residue (limit of magnesium and alkalies). If 5 Cc. of the aqueous solution, acidulated with hydrochloric acid, be mixed with an equal volume of hydrogen sulphide T.S., neither color nor turbidity should appear (absence of arsenic, lead, etc.). No turbidity should be produced by the addition of 0.5 Cc. of potassium dichromate T.S. to 5 Cc. of the aqueous solution (absence of barium)"—(*U. S. P.*). Calcium chloride has been employed in preparing artificial mineral waters, and, mixed with snow or ice, forms a powerful freezing mixture, producing a temperature as low as —48° C. (—54.4° F.).

Liquor Calcii Chloridi.—The *British Pharmacopœia* directs calcium chloride, 88 grains; distilled water, 1 ounce. Solve. It may also be prepared by dissolving in 1 ounce of distilled water 226 grains of fused calcium chloride, and filtering the solution.

Action, Medical Uses, and Dosage.—Chloride of calcium in small doses promotes secretions from the skin, kidneys, and mucous surfaces. Over the glandular system and lymphatics it exerts a specific influence, acting as a powerful resolvent in reducing hard lymphatic and glandular enlargements. Nausea, vomiting, sometimes purging, quickened pulse, præcordial anxiety, faintness, muscular weakness, tremors, and vertigo are the effects of large doses. Toxic doses act powerfully upon the nervous system, producing tremors, contracted pulse, spasms, paralysis, unconsciousness and death. Both internally and by means of a bath, chloride of calcium has a deserved reputation as a remedy in *scrofulous conditions*, with marked involvement of the lymphatic glands. *Goitre*, *paralysis* and *arthritic affections* have been successfully treated with it, and it is asserted to have cured *tabes mesenterica*—a mistake probably—but there is no reason why it should not exert a kindly action in this disorder. The conditions pointing to its selection are given below. Add 1 drachm of fresh calcium chloride to 1 pint of distilled water, cork the vessel well, and give teaspoonful or tablespoonful doses of the solution in a wine-glassful of cold water, 3 or 4 times a day. Of the liquor calcii chloridum, 10 to 60 drops in milk or water.

Specific Indications and Uses.—Lymphatic glandular enlargement; slow inflammations, with cacoplastic deposits; bad breath, with tongue dirty with pasty coat (Scudder); dyspepsia of scrofulous children, with enlarged tonsils, bad breath, irregular stools, capricious appetite, restlessness in sleep; strumous skin diseases.

CALCII HYPOPHOSPHIS (U. S. P.)—CALCIUM HYPOPHOSPHITE.

Formula: $Ca(PH_2O_2)_2$. Molecular Weight: 169.67.

Synonyms: *Hypophosphite of lime*, *Calcaria hypophosphorosa*, *Calcium hypophosphorosum*, *Hypophosphis calcicus*, *Hypophosphite of calcium*.

Preparation.—On a large scale this salt is prepared by acting upon finely divided phosphorus, with milk of lime, at the same time exposing the mixture to the air and frequently agitating it until the phosphorus is all consumed. A complicated reaction ensues, whereby phosphide of hydrogen is formed as a by-product. which ignites spontaneously in contact with the air, forming white rings of pentoxide of phosphorus and water as the products of combustion, consequently the operation, which at best is unpleasant, should be conducted under a hood, or in the open air. Prof. Procter (1858) proposed a process essentially as follows: Into a deep boiler introduce a smooth milk of lime, prepared with 5 gallons of water and 4 pounds (av.) of quick lime. Boil with this milk 1 pound of phosphorus, adding boiling water occasionally to preserve the full amount of liquid, and continue heating until all the phosphorus has become oxidized, and until it no longer evolves the odor of hydrogen phosphide. Then filter the mixture, wash the residue with water, evaporate to 6 pints, and again filter to remove the calcium carbonate and calcium hydroxide, and evaporate until a pellicle forms, when it may be set aside to crystallize, or, if desired in granulated form, it may be so obtained by stirring while still hot, and continuing the evaporation. When prepared according to this process, a large amount of the phosphorus is oxidized, forming phosphoric acid, which unites with the superabundant lime to form insoluble phosphate of calcium. Much of this loss may be averted by rendering the phosphorus spongy by passing a current of air into the water in which it is immersed.

In this way it may be made to unite with the lime at a much lower heat, or even at 15° C. (59° F.), though most readily at about 54° C. (about 129° F.); but little hydrogen phosphide is then evolved.

Description and Tests.—The *U. S. P.* describes this salt as follows: "Colorless, transparent, monoclinic prisms, or small, lustrous scales, or a white, crystalline powder, odorless, having a nauseous, bitter taste, and permanent in the air. Soluble, at 15° C. (59° F.), in 6.8 parts of water, and in 6 parts of boiling water; insoluble in alcohol. When heated in a test-tube, the salt decrepitates, and above 300° C. (572° F.) it begins to decompose, giving off water, and emitting inflammable gases (hydrogen and hydrogen phosphide), and leaving a residue of calcium pyrophosphate and metaphosphate, with some red phosphorus. The aqueous solution (1 in 20) is neutral to litmus paper, and yields, with ammonium oxalate T.S., a white precipitate insoluble in acetic acid, but soluble in hydrochloric acid. The aqueous solution, slightly acidulated with sulphuric acid, yields, with silver nitrate T.S., a precipitate which is white at first, but rapidly turns brown and black by separation of metallic silver. With copper sulphate T.S., on gentle heating, a reddish-brown precipitate of copper hydride is formed. When the aqueous solution is added, drop by drop, to mercuric chloride T.S., at first a white precipitate of mercurous chloride is formed, which, as soon as the hypophosphite solution is added in excess, turns gray from reduction to metallic mercury. If 1 Gm. of the salt be dissolved in 20 Cc. of water, no insoluble residue should be left (absence of phosphate, sulphate, and other insoluble impurities). In this solution no precipitate should be produced by the addition of lead acetate T.S. (absence of soluble phosphate); nor, after acidulating with hydrochloric acid, by barium chloride T.S. (absence of soluble sulphate); nor by an equal volume of hydrogen sulphide T.S. (absence of arsenic, etc.). On adding to 5 Cc. of the solution (1 in 20) 1 Cc., each, of ammonium chloride T.S. and ammonia water, and 3 Cc. of ammonium carbonate T.S., applying a gentle heat for a few minutes, and then filtering, not more than a very slight turbidity should be produced upon adding to the filtrate a few drops of sodium phosphate T.S. (limit of magnesium). If 0.1 Gm. of the salt be dissolved in 10 Cc. of water, then mixed with 10 Cc. of sulphuric acid and 50 Cc. of decinormal potassium permanganate V.S., and the mixture boiled 15 minutes, it should require not more than 3 Cc. of decinormal oxalic acid V.S. to discharge the red color (corresponding to at least 99.68 per cent of the pure salt)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Calcium hypophosphite belongs to the class of alteratives and restoratives. Undoubtedly much of its value is due to the phosphorus combined in it, but its whole action can not be attributed to that element. It is adapted especially to those conditions of innervation, with great depression of the nervous powers—a lack of nerve force, which so often seems to be the chief trouble in innumerable chronic diseases. It is of considerable value in *scrofulosis*, and in *incipient consumption* it was regarded by Prof. J. M. Scudder as one of the most certain agents he had ever employed (*Dis. of Child.*, p. 69). It tones the digestive organs, relieves pulmonary atony and irritation, checks the cough, gives freer respiration, and improves blood-making and nutrition. It is a constituent of the compound syrup of the hypophosphites. Dose, 2 to 10 grains, 2 or 3 times a day.

Specific Indications and Uses.—Deposits of aplastic or cacoplastic material in connective tissue, resulting in slight inflammations; tuberculosis; phthisis pulmonalis, especially in early stage; marked nervous depression.

CALCII IODIDUM.—CALCIUM IODIDE.

FORMULA: CaI_2. MOLECULAR WEIGHT: 292.97.

SYNONYMS: *Iodide of calcium, Calcium iodatum, Iodide of lime.*

Preparation.—Iodide of calcium may be prepared by acting upon a solution of ferrous iodide with milk of lime, and filtering and evaporating the solution. It may also be prepared by making a solution of slaked lime (or carbonate of calcium may be employed), in hydriodic acid, and evaporating to crystallization.

Description.—Iodide of calcium crystallizes in lustrous, pearly lamellæ, which are exceedingly deliquescent. When pure it should be white, but as ordinarily prepared, is yellowish. Water and alcohol freely dissolve it, and the solution of the salt itself will dissolve iodine. In contact with the atmosphere partial decomposition of its solution takes place, with the formation of some carbonate of calcium. This salt does not easily crystallize, and is not so stable as potassium iodide. It is usually found in commerce as a powder.

Action, Medical Uses, and Dosage.—Large doses of this salt are irritant. Putrefactive changes are arrested, and the feces deodorized by it. Material doses (1 to 3 grains 3 times a day), have been used to check *suppurative discharges*, at the same time deodorizing them, to arrest *erysipelatous inflammation*, and to promote resolution in *scrofulous ulcerations*. Calcium iodide acts chiefly upon the glandular system, and has been preferred by some over other iodine preparations in *pulmonary consumption*. It is especially serviceable in *enlarged cervical lymphatics*, and in *enlargements of the bronchial glands* as evidenced by persistent cough. Among scrofulous children, a *chronic bronchitis* with the above characteristics is likely to occur; 1 to 3-grain doses of the 1 x, 2 x, or 3 x trituration may be given several times a day. A dark-colored *iodide of lime* has been lauded as a remedy for *croup*.

Related Salt. CALCII IODAS. *Calcium iodate, Iodate of lime.* Formula $Ca(IO_3)_2+6H_2O$. Molecular weight, 496.49. This salt may be prepared by acting upon iodine with chlorinated lime in excess, in the presence of water. When decolorized, hydrochloric acid sufficient to slightly acidulate, is added, the mixture heated to 100° C. (212° F.), filtered, and allowed to crystallize. It may also be prepared by mixing gradually an excess of aqueous solution of chlorinated lime and iodine dissolved in alcohol. When this process is employed, iodine chloride is liable to be formed if the temperature is much increased. This salt exists naturally in the waters of the sea. It forms slowly efflorescing, flat, acicular crystals, without color, and presenting a shining appearance. It is not readily soluble in water, and scarcely at all in alcohol. On the addition of sulphurous acid, iodine is set free. This salt has been used but little in medicine, though it is said to reduce temperature and augment the appetite in *fevers*, when administered 3 times a day in from 2 to 4-grain doses. On account of its reputed antiseptic qualities, it has been proposed as a food preservative.

CALCII PHOSPHAS PRÆCIPITATUS (U. S. P.)—PRECIPITATED CALCIUM PHOSPHATE.

FORMULA: $Ca_3(PO_4)_2$. MOLECULAR WEIGHT: 309.33.

SYNONYMS: *Calcium phosphoricum*, *Precipitated phosphate of lime*, *Bone phosphate of lime*, *Bone phosphate*, *Calcaria phosphorica*, *Calcii phosphas* (*Br.*).

Preparation.—Take of finely powdered calcined bone, 2 ounces; hydrochloric acid, 4 ounces; ammonia water, 6 fluid ounces; distilled water, a sufficient quantity. Digest the calcined bone in the hydrochloric acid diluted with 8 fluid ounces of the water, until it is all dissolved. Then filter the solution and add to it 8 fluid ounces more of the water, and afterward the water of ammonia, gradually adding it until the fluid acquires an alkaline reaction. The precipitate thus obtained must be collected on a calico filter, and, to remove any ammonium chloride that may be present, washed with boiling distilled water as long as the liquid which passes through occasions a precipitate when dropped into a solution of nitrate of silver acidulated with nitric acid. Dry the washed product at a temperature not exceeding 100° C. (212° F.).

The *U. S. P.* (1870), and the *British Pharmacopœia*, direct bone ash, 4 ounces; water, 2 pints; hydrochloric acid, 6 (*Br.*), [8 (*U. S.*)] ounces; solution of ammonia, 12 ounces (or a sufficient amount), and distilled water, q. s. After digesting the bone-ash in the diluted hydrochloric acid, the solution is boiled (*Br.*) for a few moments, after which the procedure is essentially that given above. The *German Pharmacopœia* prepares a more soluble salt by precipitating with sodium phosphate a solution of sodium chloride. Its formula is $CaHPO_4+2H_2O$.

Description and Tests.—"A light, white, amorphous powder, odorless and tasteless, and permanent in the air. Almost insoluble in cold water; partly decomposed by boiling water, which dissolves out an acid salt; almost insoluble in acetic acid, except when freshly precipitated; easily soluble in hydrochloric or nitric acid; insoluble in alcohol. At an intense white heat the salt fuses without decomposition. When moistened with silver nitrate T.S., a yellow color is assumed by the salt either before or after ignition (distinction from acid calcium phosphate, which, after ignition, when moistened with silver nitrate, remains white). For applying tests of identity and purity, shake 2 Gm. of the salt with

20 Cc. of water, and add nitric acid, drop by drop, until solution is effected; and then add water to make the liquid measure 40 Cc. No effervescence should occur on adding the acid (absence of carbonate). From a portion of this solution the salt is precipitated unchanged by a slight excess of ammonia water. From another portion ammonium molybdate T.S. precipitates yellow ammonium phosphomolybdate; the reaction is accelerated by a gentle heat. If to 5 Cc. of the solution, acidulated with nitric acid, 0.5 Cc. of silver nitrate T.S. be added, not more than a slight turbidity should result (limit of chloride). The clear solution should not be rendered turbid by barium chloride T.S. (absence of sulphate); nor by potassium sulphate T.S. (barium); nor by an equal volume of hydrogen sulphide T.S. (arsenic, lead, etc.); nor should it be colored blue by potassium ferrocyanide T.S. (iron). If 5 Cc. of the solution be mixed with 1 Cc. of sodium acetate T.S., and then with ammonium oxalate T.S., until the calcium is completely precipitated, the filtrate should not be rendered very turbid by adding ammonia water in slight excess (limit of magnesium)"—(*U. S. P.*). Prolonged boiling with water slowly decomposes it, forming a soluble acid phosphate, and an insoluble basic phosphate of calcium ($Ca_5[PO_4]_3OH$).

Action, Medical Uses, and Dosage.—Phosphate of calcium was at one time considered a useful remedy in *rickets* and *mollities ossium*, its application to these diseases being based upon a theoretical inference from the state of the bones, which are known to be deficient in their calcareous constituents. Later it was presented to the profession as a remedy in the treatment of *tuberculous affections*, as *scrofula*, *pulmonary consumption*, etc. But it is extremely doubtful whether the beneficial results following its use are due to it, or to the other agents with which it is usually associated, as cod-liver oil, preparations of iron, etc. The following compound has been recommended in *phthisis*, *scrofula*, *chloro-anemia*, *mollities ossium*, *caries*, and *oxaluric gravel:* Take of precipitated phosphate of calcium, 30 parts; precipitated carbonate of calcium, 20 parts; bicarbonate of sodium, 6 parts; mix thoroughly together. The dose is 1 or 2 drachms in sweetened water, every morning and evening. Recently, some of our practitioners, basing their views partially upon homœopathic uses of the drug, have declared it a valuable remedy for that form of *malnutrition* in which the teeth, bones, connective tissue, and blood corpuscles suffer. *Rachitis*, *tardy union in fractures*, *ulcers* and *abscesses* of a scrofulous character, with rapid melting away of soft structures, exhaustive discharges, as *colliquative sweats of debility*, *leucorrhœa*, *bronchorrhœa*, *malnutrition during dentition*, *marasmus* following *cholera infantum* and *anemic conditions* are those in which it has been successfully used. In *chronic tonsillar* and *faucial irritation* in scrofulous patients, malnutritive states following child-bearing and suckling, and in *menstrual derangements* with debility and exhausting discharges, it has been highly commended. Small doses (1 or 2 grains), of the crude salt, or the triturations, may be employed. Some prefer the 3 x trituration. Dose of precipitated phosphate of calcium, 1 to 30 grains.

Specific Indications and Uses.—Strumous diathesis; profuse discharges, leucorrhœa, and profuse menstruation; debility after child-bearing; colliquative sweats, hectic fever; anemia; osteal and dental malnutrition.

Preparations and Related Bodies.—SYRUPUS CALCII PHOSPHATIS, *Syrup of phosphate of calcium.* Precipitated phosphate of calcium, 1 troy ounce; phosphoric acid, a sufficient quantity to dissolve the calcium salt without having an excess of the acid. Add simple syrup to make 1 pint of the finished product. Hydrochloric acid has been employed as a solvent, but phosphoric acid is better for this preparation.

OS.—*Bone.* The bones of the vertebrate animals consist of a compact organic tissue, impregnated with calcareous depositions. When fresh they are pinkish-white; when dried, a dull, ivory white. Water does not, but acids partially dissolve them, taking up the inorganic constituents, and leaving behind a gelatinous framework, called *ossein.* On the other hand, when calcined in the open air, the organic portion is totally destroyed, leaving a white, porous residue of inorganic matter. When heated in closed vessels by destructive distillation, a porous charcoal—*carbo animalis*—is produced, while ammoniacal products are given off. The organic constituent, *ossein*, when long boiled, yields gelatin. Bones of different species, different bones of the same animal, and different portions of the same bone, vary in the proportion of inorganic matter. The outer or *compact tissue* of bone contains the most, sometimes as high as 66 per cent; the inner or *cancellous tissue*, contains the least, sometimes as much as 40 per cent. Æby, in 1874, advanced the theory that the chief inorganic constituents of bone were combined with a chemical salt of the structure, $3Ca_3(PO_4)_2CaCO_3$, and probably with water, and mixed with carbonate of calcium. The ash of bone is recognized in the *British Pharmacopœia* as *Os ustum* or *Bone ash*, and defined as "the residue of bones which have been burned to a white ash in contact with air. Bone consists principally of phosphate of calcium mixed with about 10 per cent of carbonate of calcium, and a little fluoride of calcium, silica, and phosphate of magnesium" (*Br. Ph.*). *Bone ash* or *bone earth* is employed chiefly in the preparation of calcium and sodium phosphates, glacial phosphoric acid, and phosphorus. *Bone ash* contains approximately traces of iron, silica, manganese, and sodium chloride, and less than 1 per cent of calcium fluoride, 1 to 2.7 per cent of magnesium phosphate, 5 to 10 per cent of calcium carbonate, and 75 per cent of calcium phosphate (the chief constituent). One hundred parts of ox bones (dry), 3.45 parts of soda with a small portion of sodium chloride, 2.05 parts of magnesium phosphate, 3.85 parts of calcium carbonate, 57.35 parts of calcium phosphate, with a little of calcium fluoride, and 33.3 parts of bone gelatin, the organic constituent (Berzelius). Gelatin, size, and glue are obtained from the organic constituent of bones. Animal jellies, isinglass, etc., are prepared from them. The hoof-bones of cattle yield the oil known as *neat's-foot oil* (*Oleum bubulum*).

Superphosphate of Lime is extensively employed as a fertilizer. It contains organic matter, a small amount of magnesium compounds, acid calcium phosphate ($Ca[H_2PO_4]_2$) (22 or 23 per cent), and calcium sulphate (about 50 per cent). It is prepared by treating ground bones with about 50 per cent, by weight, of sulphuric acid. Such a mixture is employed also to extract ammonia from illuminating gas, forming besides the superphosphate of lime, a portion of phosphate and sulphate of ammonium, very valuable as an artificial manure.

CALCII SULPHAS EXSICCATUS (U. S. P.)—DRIED CALCIUM SULPHATE.

"A powder containing about 95 per cent, by weight, of calcium sulphate ($CaSO_4 = 135.73$), and about 5 per cent of water; prepared from the purer varieties of native gypsum ($CaSO_4 + 2H_2O = 171.65$), by carefully heating until about ¾ of the water has been expelled. Dried calcium sulphate should be kept in well-closed vessels, carefully protected from moisture"—(*U. S. P.*).

Synonyms: *Plaster of Paris, Dried gypsum, Calcii sulphas* (*Br.*).

Description and Tests.—Plaster of Paris is "a fine white powder, without odor or taste. From moist air it attracts water, becomes granular, and then loses the property of hardening with water. When mixed with half of its weight of water, dried calcium sulphate forms a smooth, cohesive paste, which rapidly hardens. It is soluble in about 410 parts of water, at 15° C. (59° F.); in 388 parts, at 38° C. (100.4° F.); and in 476 parts, at 100° C. (212° F.). In alcohol it is insoluble. It readily dissolves in diluted nitric or hydrochloric acid, also in saturated solutions of potassium nitrate, sodium hyposulphite, and of various ammonium salts. When heated above 204° C. (399.2° F.), dried calcium sulphate becomes anhydrous and loses the property of forming a paste with water and hardening rapidly. Its saturated solution in water should be neutral to litmus paper. It forms white precipitates with barium chloride T.S., with ammonium oxalate T.S., and with alcohol. No effervescence should occur on the addition of diluted acids to dried calcium sulphate (absence of carbonate)"—(*U. S. P.*). Plaster of Paris hardens without decrease of bulk.

Surgical and Other Uses.—Plaster of Paris is chiefly used as an immovable *surgical dressing*, and as a material for preparing plaster casts as well as molds for the same and wax figures. The method is as follows: Into a common pasteboard box of sufficient depth and size, pour a quantity of plaster of Paris, mixed with water, to the consistence of a soft magma, so that it will not run, but receive the impression of the article of which a mold is desired, and thick enough to quickly "set." Now, take the article, an apple for instance, grease it well and press it down to that portion of the model at which the dimensions begin to diminish. Allow the plaster to harden, and, without removing the apple, cut a conical depression, one on each side, into the plaster surface, a little distance from the apple, and again apply grease to the exposed portion of the fruit and to all of the exposed surface of the plaster, including the depression. Now, fill the box completely with more plaster of the same consistence as that first employed, completely burying the apple. Allow the mass to harden, when the two halves of the mold will readily come apart, and the fruit may be removed. The cut depressions in the lower half will have received plaster in the form of pegs depending from the upper half, and these will serve to accurately fit the parts of the mold together when in use. Now cut a gutter in one-half of the mold, or in both opposed to each other, and the instrument is finished. To reproduce the figure, instrument, etc., in wax, all that is necessary is to bring the wax to a fluid state by heat and pour through the gutter a small quantity into the mold (previously thoroughly greasing inside), and then slowly revolve the mold until the wax has hardened. Separate the mold and remove the figure. To reproduce in plaster follow the same procedure, using a milk of plaster of Paris; if the figure is desired solid fill the mold full.

This process may be used to reproduce the shapes of instruments, surgical deformities, injuries, etc., but in order to obtain a mold of a part of the body, the hair must first be shaven from the part else much pain will be experienced in removing the mold from the flesh.

Plaster of Paris is the substance used in preparing the fixed surgical appliance known as the *plaster of Paris dressing*. To do this, take a roller of soft, coarse-meshed cloth—cheese-cloth, crinoline, flannel, or muslin, the latter is preferred—and rub into the meshes dry plaster and roll the bandage tightly. These may be used at once, or kept in air-tight, dry boxes until needed. To use these pour upon each end of the roller some cold water, or immerse the roller in the water. First apply a dry cloth without plaster and follow with the moistened plaster-impregnated bandage, being careful not to execute any reverses in applying the roller. It dries quickly and forms a light, hard dressing. When applied to the body it may be cut longitudinally and eyelets inserted, so as to serve as a *plaster jacket*. Plaster dressings are applied to *fractured limbs* and *ribs*, and certain *spinal deformities*. Many object to them on account of their concealing the injury and the liability of shortening, strangulation, and other accidents which may result from their unskillful application.

Related Compound.—CALCII SULPHAS. *Gypsum, Native calcium sulphate.*—This compound occurs in nature in the form of transparent prismatic bodies, known as *selenite*, or as white, somewhat opaque masses, termed *alabaster*. Gypsum is often beautifully colored by impurities present. Another beautiful modification is known as *satin-spar*, or *fibrous gypsum*, from which many ornaments may be made. Ground gypsum, popularly known in rural sections as "land plaster, or plaster," is used extensively in agriculture to spread upon the soil, and as a medium (or dilnent) by which paris green may be applied to potato plants for the destruction of the Colorado beetle. It may be artificially prepared by precipitating calcium compounds with a sulphate, or with sulphuric acid. In this way it occurs as a crystalline, white powder, sparingly soluble in hot water, and more soluble in cold water. It refuses to dissolve in alcohol. But very little use has been made, in our school, of calcium sulphate as an internal remedy. Webster, however, following Schuessler, of "tissue-remedy" fame, states that it is a remedy closely allied to calcium sulphide, as a remedial agent in *suppurative states* of the connective tissues. It has been used in a variety of troubles, mainly of a scrofulous suppurative nature, much after the method of using calcium sulphide. Five grains of the 3 x trituration is added to 4 fluid ounces of water, and teaspoonful doses administered every 2 hours in acute, and every 4 hours in chronic disorders. The preparation used by Homœopathists is that prepared by acting upon solution of calcium chloride with diluted sulphuric acid, washing the precipitate with hot water, and drying the product at a heat near 30° C. (86° F.)—(*Am. Hom. Pharm.*).

CALCII SULPHIS.—CALCIUM SULPHITE.

FORMULA (of anhydrous salt): $CaSO_3$. MOLECULAR WEIGHT: 119.76.

FORMULA (of crystallized salt): $CaSO_3+2H_2O$. MOLECULAR WEIGHT: 155.68.

Preparation.—Sulphite of calcium may be made by mixing a solution of a normal sulphite with a solution of a salt of calcium. Also, by making a thick paste with slaked lime and water, spreading in thin layers, and passing sulphurous acid gas over it until absorption of the gas ceases. The latter is the process employed on a large scale.

Description.—This salt is a white powder of a weak, sulphurous taste, and is known in commerce as *sulphite of lime*. It is soluble in 800 parts of water, and freely soluble in solution of sulphurous acid, without effervescence. If effervescence ensues, carbonate of calcium is present as an impurity. When the solution in sulphurous acid is exposed to the atmosphere, the acid escapes, and 6-sided needles of the composition $CaSO_3+2H_2O$ separate. Sulphite of calcium is chiefly consumed by cider-makers, as the addition of a small amount will retard or check the vinous fermentation. For this purpose it has been customary to permit fermentation to progress until the cider is of the desired quality, then to add to it sulphite of calcium in the proportion of 4 or 6 ounces to the cask of 40 gallons of cider, then agitate well, permit the turbid liquid to settle, and afterward, as desired, draw off the clear cider. The impurities that may be expected to exist in sulphite of calcium are such as are contained in the lime from which it is prepared, as, carbonate of calcium from previous exposure of the slacked lime to atmospheric action, and sulphate of calcium, both in varying proportions. The latter substance is gradually produced when sulphite of calcium is exposed to the atmosphere.

Action, Medical Uses, and Dosage.—Sulphite of calcium and "bisulphite of lime" (see below), possess properties similar to other sulphurous acid preparations, being disinfectant and antiseptic. They are mostly employed for the purpose of checking fermentation in fluids liable to undergo such action. They are rarely employed in medicine, except, occasionally, to disinfect and stimulate *obstinate ulcers* of long standing. For internal use, there are several other sulphites before the profession that are preferred. Dose, 5 to 60 grains.

Related Compound.—BISULPHITE OF LIME. The solution of sulphite of calcium in sulphurous acid water is known in commerce as *bisulphite of lime*, and is produced by passing sulphurous acid into milk of lime. It is a clear liquid of a suffocating sulphurous odor, and is said to be used by brewers for the purpose of giving stability to beer (Roscoe and Schorlemmer), and is occasionally employed by fruit preservers, in small proportion, for the purpose of preventing fermentation in canned fruit. It is useful for preserving anatomical specimens and animal tissues of several kinds. It is also considerably employed to prevent fermentation in cider, wine, etc.

CALENDULA (U. S. P.)—CALENDULA.

The florets and leaves of *Calendula officinalis*, Linné.

Nat. Ord.—Compositæ.

COMMON NAMES: *Calendula, Marigold, Marygold, Garden marigold.*

Botanical Source.—Calendula officinalis has a fibrous, annual root, with a stem about a foot high, having many patent, dichotomous, or sometimes trichotomous branches, which are striated, green, succulent, and hispido-pubescent. The leaves are alternate, oblong, acute, mucronate, sessile, somewhat succulent, broad, a little cordate at the base, the margins quite entire, often scabrous-ciliate. The flower-heads are large, terminal, solitary upon each branch, of a rich, full, golden yellow, deeper and brighter previous to their full expansion. The involucre consists of many nearly equal, appressed, linear-subulate, pilose-hispid leaves or scales, not one-third as long as the radiant florets, the apices a little recurved. Achenia carinate, muricate, incurved. Corollas of the ray ligulate, female tridentate, broadly linear, lower tubular portion hairy; ovary singularly boat-shaped, curved like a horse-shoe, large, green, downy within, having a thickened margin, more or less tuberculated on the back. The florets of the center are all tubular, small, male, and consequently sterile; mouth 5-cleft, base hairy. The abortive ovaries are cylindrical, downy, and green. Receptacle dotted (L.—W.).

History.—Calendula is a native of South Europe and the Orient. It is a common garden herb, with a feeble, aromatic, somewhat narcotic, though not very unpleasant smell, and a salty, austere, rather disagreeable taste. The leaves, and more generally the flowers are used, and impart their active properties to alcohol or boiling water. The dried plant has a much weaker odor and taste. The dried flower heads are occasionally found in commerce. The *French* and the *African marigold* of our gardens, *Tagetes erecta*, Linné, and *Tagetes patula*, Linné, respectively, natives of the tropics, have been sold for true calendula, and it is believed that much of the fluid preparations of calendula are prepared from these plants.

Description.—"Florets about 12 Mm. ($\frac{1}{2}$ inch) long, linear and strap-shaped, delicately veined in a longitudinal direction, yellow or orange-colored, 3-toothed above, the short, hairy tube enclosing the remnants of a filiform style, terminating in 2 elongated branches; odor slight and somewhat heavy; taste somewhat bitter and faintly saline"—(*U. S. P.*).

Chemical Composition.—Geiger, who examined this plant in 1819, found gum, sugar, an amorphous, bitter body, a minute quantity of volatile oil, and a tasteless, yellow substance to which the name *calendulin* was applied. *Calendulin* is obtained by digesting the flowers and leaves of marigold in alcohol, and then evaporating the solution to the consistence of an extract. This must first be digested in ether, which dissolves a substance analogous to wax, and afterward in water. The mucilaginous substance which remains is the calendulin. It is, when dried, yellowish, translucent, and brittle; it swells up and forms mucilage with water; it dissolves in hot water, but assumes the form of jelly on cooling. It is insoluble in the diluted acids, alkaline carbonates, lime, ether, and the fixed and volatile oils, and soluble in concentrated acetic acid, diluted solutions of the caustic alkalies, and in absolute alcohol. It is not precipitated by tannin.

Action, Medical Uses, and Dosage.—Slightly stimulant and diaphoretic. Used for similar purposes with saffron, but less active. Has been reputed useful in *spasmodic affections*, *strumous maladies*, *icterus*, *suppressed menstruation*, *typhoid febrile conditions*, *cancer*, etc. Used in infusion or in the form of extract, from 4 to 6 grains, 3 or 4 times a day; also applied locally to *cancerous* and other *ulcers*. Probably overestimated. Its chief use is as a local remedy. Dr. William J Clary, of Monroeville, Ohio, writes me as follows, in relation to this plant: "As a local remedy after surgical operations, it has no equal in Materia Medica. Its *forte* is its influence on *lacerated wounds*, without regard to the general health of the patient or the weather. If applied constantly, gangrene will not follow, and. I might say, there will be but little, if any, danger of tetanus. When applied to a wound it is seldom that any suppuration follows, the wound healing by replacement or first intention. It has been tested by several practitioners, and by one, is used after every surgical operation with the happiest effect. You need not fear to use it in wounds, and I would not be without it for a hundred times its cost. It is to be made into a saturated tincture with whiskey diluted with one-third its quantity of water; lint is saturated with this, applied to the parts, and renewed as often as it becomes dry."

The statement of Dr. Clary has stood the test of time, and now hundreds of advocates of calendula endorse it. It may be used well diluted for the *chafing* and *excoriations* of infants. Michener (*Cal. Med. Jour.*), claims remarkable results from its use in *gangrenous* and *indolent ulcers* with capillary impairment. Use 1 part of specific calendula to 3 parts of water, locally, keeping the parts constantly wet. Teaspoonful doses every 4 hours of a solution of specific calendula flʒj, in water fl℥iv, are to be given at the same time. He also uses it successfully after *surgical operations* to induce healing by first intention, to wash *abscess cavities*, to prevent cicatrization from *burns* and *scalds*, in *eczematous* and *ulcerative skin diseases*, *vaginitis* (wash or tampon), *endocervicitis*, *gonorrhœa*, *non-specific urethritis*, and *mercurial stomatitis*. Dr. Bradner (*An. of Ec. Med.*, 1890), states that cavities from which *epitheliomatous growths* have been removed, heal quickly under the use of the evaporated fluid extract mixed with petrolatum. Locally, by atomizer, the doctor directs: ℞ Tr. calendula, gtt. x to lx; ol. petrolatum, ʒi. Mix. In *catarrhal conditions* of the nose and throat, with raw and tender membranes, its action is kindly and soothing. Lamoreaux (*An. of Ec. Med.*, 1890), uses it in mild *conjunctivitis* in the proportion of 5 drops to the ounce of rose water; and as a dressing for *lacerated perineum* he states that it operates to prevent pain and swelling. In obstetric practice it is of value to relieve burning and smarting after delivery, and relieves to some extent the pain and tenderness of *excoriated nipples*. In *vaginitis*, *endometritis*, all *uterine* and *vaginal abrasions*, and *non-malignant ulcerations*, *leucorrhœa*, and as an intra-uterine wash, calendula has received strong endorsement. It is a vaso-motor stimulant, and relieves capillary engorgement of the mucous tissues and skin. *Congestion of the nasal membranes* and its consequent unpleasantness are removed by it. *Uterine subinvolution* and *vaginal engorgements* are thus relieved. It stimulates *ecchymosed tissues*, and has been recommended in *varicoses* of the lower limbs, using it both locally and internally. Locally, it is applied diluted to inflamed conjunctival and aural tissues, and to *traumatic injuries of the eye and ear*. Foltz (*Dynam. Ther.*) employs it in *suppurative otitis media* as follows: ℞ Specific calendula, flʒj; boric acid, ℥j. Mix. Ft. chart, No. 1. Use by insufflation. Prof. Webster values it in *superficial skin affections*, even where there are long-standing inflammatory indurations, as in stubborn *acne*. Use it both locally and internally. Locally, specific calendula (the best form), from 1 to 4 parts of water to full strength; internally in doses 1 to 10 drops.

Specific Indications and Uses.—Locally, to wounds and injuries to prevent suppuration and promote rapid healing. Internally, to aid local action, and in chronic suppuration, capillary engorgement, varicose veins, old ulcers, splenic and hepatic congestion.

Related Species.—*Calendula arvensis*, Linné. A cultivated species, smaller than the preceding, and having lighter-colored flowers, undoubtedly having properties similar to those of the foregoing species, its taste and odor being similar.

CALLITRICHE.—WATER-STARWORT.

The whole plant, *Callitriche verna*, Linné.

Nat. Ord.—Callitrichaceæ.

COMMON NAMES: *Water-starwort*, *Water-chickweed*.

Botanical Source.—This plant is a small aquatic annual herb, which floats upon the water, the stem being 1 or 2 feet in length, and composed of 2 tubes, simple or branched. The leaves are opposite, 3-nerved; upper ones oblong-spatulate, two at each node, crowded above into a star-like tuft upon the surface of the water; lower ones becoming gradually narrower, the lowest quite linear, obtuse or emarginate. The flowers are very minute, white, axillary, solitary, or in pairs, and often monœcious; the anther is a little exserted and yellow; the styles constantly erect; the fruit nut-like, indehiscent, 1-celled, and 4-seeded; the seeds peltate and albuminous (W.).

History.—This plant is common to the United States, growing in shallow streams and muddy places, and flowering from April to September. The whole plant is used; it yields its properties to water, or alcohol. There are several varieties, as *C. autumnalis*, *C. austinii*, *C. heterophylla*, all of which possess similar medicinal virtues.

Action, Medical Uses, and Dosage.—This plant is a very valuable diuretic, and has been found advantageous in some *affections of the kidneys* and *bladder*, *dropsy*, and *gonorrhœa*. A decoction of it may be drank freely, according to its diuretic influence. In dropsy, a tincture made with whiskey is preferred. The plant deserves more attention than it has heretofore received.

CALUMBA (U. S. P.)—CALUMBA.

"The root of *Jateorhiza palmata* (Lamarck), Miers"—(*U. S. P.*) (*Cocculus palmatus*, Wallich).

Nat. Ord.—Menispermaceæ.

COMMON NAMES: *Columbo*, *Colombo.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 13.

Botanical Source.—Colombo is a climbing plant, with a perennial root, formed of a number of fasciculated, fusiform, somewhat branched, fleshy, curved, descending tubers, of the thickness of an infant's arm, covered with a thin. brown epidermis, marked, especially toward the upper part, with transverse warts; internally they are deep yellow, inodorous, very bitter, filled with numerous, parallel, longitudinal fibers, or vessels. The stems, of which 1 or 2 proceed from the same root, are annual, herbaceous, about as thick as the little finger, simple in the male plant, twining, branched in the female, rounded and green; in the full-grown plant, below, they are thickly clothed with succulent, longitudinal hairs, which are tipped with a gland. The leaves are alternate and large; the younger ones thin, pellucid, bright-green, generally 3-lobed, and upward gradually more numerous; the older ones remote, a span in breadth, nearly orbicular, deeply cordate, 5 to 7-lobed, the lobes entire, often deflexed, wavy on the surface and margin, dark-green above, paler beneath; hairy on both sides; the nerves, according to the number of lobes, are 3, 7, or 9, pale, connected by veins which, in themselves, are reticulated and are prominent beneath. The petioles are about as long as the leaves, rounded, glanduloso-pilose, and thickened below. The flowers are small, indistinct, arranged in the male plant in solitary, axillary, drooping, compound racemes, covered with glandular hairs, and with small, caducous bracts at the base; in the female they are also axillary, solitary, simple, spreading, but shorter than those of the male. Sepals 6, glabrous; petals 6, in a single row; stamens 6; anthers terminal and 4-celled. The fruit is drupaceous, or berried, about the size of a hazel-nut, densely clothed with long, spreading hairs, and tipped with a black, oblong gland. The seeds are black, striated transversely, and subreniform (L.).

History.—This plant inhabits the forests near the coast of Mozambique, and Oibo in East Africa, and has been cultivated at Madras, and in the Isle of France. It was formerly incorrectly described as *Menispermum palmatum*, and has more recently been properly investigated and classified. It grows abundantly on the southeastern coast of Africa, where in the neighborhood of Mozambique, it is known by the name *Kalumb*. The root is dug up in the dry season in the month of March, and is very fibrous and ligneous, only its spindle-shaped offsets are removed, being cut in slices, strung on cords, and hung up to dry in the shade.

Description.—As met with in commerce, colombo root consists of transverse sections from ½ an inch to 3 inches in diameter, and from 1 to 8 or 10 lines thick. These sections are composed of a thin, olive-brown and generally rugose cuticle; a thick, bright-yellow, easily detached inner bark; and a pith or spongy ligneous internal structure of a pale-brown or yellowish color, more or less contracted, often exhibiting dark concentric rings with radiated striæ. The best pieces are those which are firm, dense, and regular, of a lively color, and not much injured by insects. The root is friable and readily reduced to a pale greenish-yellow powder, having a faintly aromatic odor, and an unpleasant, bitter taste, without the slightest acrimony or astringency. Alcohol, or boiling water, extracts its virtues. The bark has the strongest taste, which is readily taken up by water, alcohol, or ether. The central pith is almost mucilaginous. The powder soon spoils and becomes unfit for use, in consequence of absorbing moisture from a damp atmosphere. It is better to powder the root in limited portions, when required, keeping the powder in closely-stoppered bottles (P.). The *U. S. P.* describes it as "in nearly circular disks, 3 to 6 Cm. (1⅖ to 2⅓ inches) in diameter, externally greenish-brown and wrinkled, internally yellowish, or grayish-yellow, depressed in the center, with a few interrupted circles of projecting wood-bundles, distinctly radiate in the outer portion; fracture short, mealy; odor slight; taste mucilaginous, slightly aromatic, very bitter"—(*U. S. P.*).

Adulterations.—The American colombo (*Frasera Walteri*, Michaux), which is sometimes added to the genuine article, contains no starch, and is not, therefore, affected by iodine; but it contains tannic acid, and, therefore, becomes blackish-green when sulphate of iron is added to its decoction, and yields a precipitate with a solution of gelatin (P.). White bryony (*Bryonia alba*) root is said to have been an adulterant also. Both this and American columbo root can be detected by their widely divergent physical characteristics, so different from calumba. A wood, known as *false columbo*, or *columbo wood* (from *Coscinium fenestratum*), also of the Moonseed family, has been received into England from Ceylon.

Chemical Composition.—According to Planche and Buchner, the root contains bitter matter, yellow resinous extractive, volatile oil, wax, gum, starch, vegetable medulla, woody fiber, and water. Wittstock, in 1830, discovered a bitter principle, which he named *colombin*, or *columbin*. If the genuine columbo be first moistened, it does not become black when in contact with tincture of iron; iodine added to a decoction of the root, forms the blue iodide of starch; a decoction of the root does not redden litmus paper, nor is there any precipitate (tannic and gallic acids) when tartar emetic, gelatin, or sulphate or perchloride of iron are added to it; infusion of nut-galls, or tannic acid cause a precipitate.

Columbin ($C_{42}H_{44}O_{14}$) may be obtained by treating columbo root twice or thrice successively with alcohol of specific gravity 0.835. Mix these solutions, distill off ¾ of the alcohol, and allow the residual liquid to remain at rest for some days. Crystals are deposited which may be collected by throwing the whole on a cloth and allowing the liquid portion to pass. These crystals are to be washed in cold water, dissolved in alcohol, and the solution digested with ivory-black, and filtered. When the solution thus treated is concentrated, it deposits pure crystals of columbin. The mother liquor still contains abundance of the same principle, which may be separated by mixing it with powdered glass and evaporating to dryness, stirring it constantly when it begins to become concrete. Digest this mixture of powder and glass in ether, which dissolves wax, fatty matter and columbin. Distill off the ether, digest the residue in boiling acetic acid, which takes up only the columbin, then evaporate, and crystals are formed. Sixty grains are obtained from ½ pound of the root. Columbin crystallizes in transparent rhombic prisms, which are inodorous, but very bitter. They are neutral, little soluble in water, alcohol, or ether, at ordinary temperatures, yet give a bitter taste, to them; boiling alcohol dissolves from $\frac{1}{40}$ to $\frac{1}{30}$ of its weight, but on cooling deposits them. Volatile oils sparingly dissolve them. The caustic alkalies dissolve columbin, from which it is precipitated unaltered by acids; nitric and sulphuric acids dissolve it, but hydrochloric acid has very little action on it. Boiling acetic acid of specific gravity 1.04, is its best solvent (T.).

Berberine ($C_{20}H_{17}NO_4$) exists in colombo root to a large extent, being in union with *columbic acid*. Dr. Bödeker obtained it by exhausting the columbo root with boiling alcohol of specific gravity 0.889, removing as much of the alcohol as possible by distillation; and when a yellowish-brown mass of impure columbin had separated after 3 days' standing, the supernatant liquid, together with the aqueous solution arising from the rinsing of the impure columbin, was evaporated to dryness on a water-bath. The residue was exhausted with boiling alcohol of specific gravity 0.863, and this solution again treated as the preceding one. The residue was then treated with boiling water, and the filtered solution mixed with a considerable quantity of hydrochloric acid. The precipitate thus formed was collected on a filter, and well pressed between paper. Owing to its great solubility in pure water and alcohol, it could not be washed. To remove any free adherent acid, it was dissolved in alcohol of 0.863, and precipitated from this solution by ether. The salt obtained was an indistinctly crystalline bright-yellow powder, of an unpleasant bitter taste, and believed to be the hydrochlorate of berberine (*Amer. Jour. Pharm.*, Vol. XX., p. 322). We have not verified these experiments, but, in our opinion, if the resultant salt is, as stated, very soluble in water, it is *not* hydrochlorate of berberine. *Columbic acid* ($C_{22}H_{24}O_7$) is amorphous, but sparingly soluble in water (cold), but dissolves in diluted alkalies and alcohol, is of a pale-yellow color, and bitter to the taste.

Columbine, a white body, has been obtained by Alessandri (1882), who believes it to be an alkaloid. It was prepared by neutralizing an infusion of calumba made with oxalic acid solution (3 per cent) and evaporated to one-third, cooled, ether added, and the solution again evaporated, when pure columbine remains—(*L'Orosi*, Vol. I; *P. J. Tr.*, 1882, p. 995).

Action, Medical Uses, and Dosage.—A pure, bitter tonic, which neither stimulates nor astringes. It acts upon the stomach much like hydrastis. Used in *dyspepsia*, *chronic diarrhœa*, and *dysentery;* in convalescence from *febrile* and *inflammatory diseases*, *hectic fever*, *dysentery* and *diarrhœa;* and in the *muscular debility* of young children. It has been efficient in *sympathetic vomiting*, not connected with gastritis, as in *pregnancy*. Like other strong bitters, it occasionally checks the *remittent* and *intermittent fevers* of hot climates. A powerful tonic may be formed of the alcoholic extract of the root. In *dyspepsia* and *vomiting*, it may be advantageously combined with the alkaline bicarbonates, as well as in debility with acidity of the stomach. It is used in various combinations, with aromatics, antacids, cathartics, or other tonics. It is particularly useful in *dyspepsia*, with constipation and hepatic torpor, and should be employed in 5-drop doses of specific calumba associated with a light dose of specific rheum or leptandra, to be given 5 or 6 times a day. In *cholera morbus* it stops the vomiting and purging, and imparts strength; after the active phases of *cholera infantum*, when an unirritating tonic is desired, this agent is to be preferred. Dose of the powder, from 10 to 30 grains, 3 or 4 times a day; of the infusion, from 1 to 2 fluid ounces; of the tincture, from 1 to 2 fluid drachms; of specific calumba, 5 to 30 drops, 3 to 5 times a day. Colombin is highly useful in the treatment of *dyspepsia*, in doses of from ¾ of a grain to 2½ grains daily.

Specific Indications and Uses.—Enfeebled stomach, with indigestion, or feeble digestion; anorexia, and general debility.

CALX (U. S. P.)—LIME.

Formula: CaO. Molecular Weight: 55.87.

"Lime prepared by burning white marble, oyster shells, or the purest varieties of natural calcium carbonate. It should be kept in well-closed vessels, in a dry place"—(*U. S. P.*).

Synonyms: *Calcium monoxide*, *Caustic lime*, *Quicklime*, *Calcii oxidum*, *Calcaria*, *Calx usta*, *Calx viva*, *Burned lime*, *Oxydum calcicum*.

Source and Preparation.—Lime does not exist in the pure or caustic state in nature, because if exposed in this condition it would rapidly absorb carbonic acid gas. It is prepared by heating a natural carbonate of calcium, by which process its carbonic acid gas is set free, while the lime is left in the residue. It is found purest in limestone, chalk, marble, and the shells of oysters. That procured from the last two is quite pure and especially suited for the delicate investigations in the chemical laboratory. The Edinburgh College ordered white marble, broken into small fragments, to be heated "in a covered crucible at a full red heat for 3 hours, or till the residuum, when slaked and suspended in water, no longer effervesces on the addition of hydrochloric acid." After the lime has become cool, it should be at once secured in well-closed vessels, to prevent it from absorbing carbonic acid gas from the atmosphere, which it does very speedily. This gives a very pure product. The burning of the limestone on a large scale is conducted in *lime-kilns* in such a manner that a good draught of air passes through the heated lime-stones. The chemical reaction involved is as follows: $CaCO_3 = CaO + CO_2$. If not conducted with a good draught the liberated carbonic acid gas would surround the limestones and prevent them, even at a high heat, from parting with the remaining carbon dioxide. As ordinarily prepared it contains a large amount of impurities, notably ferric oxide, magnesia, alkaline compounds, clay, and silica. The presence of much clay causes it to slack slowly and feebly, or scarcely at all, the cause being the formation of a glaze of calcium silicate, which obstructs the free access of water, and when this is the case it is commonly called "*poor lime*" or "*over-burnt lime*." It may be obtained pure by calcining pure carbonate of calcium in a crucible, moistening the resulting product, and recalcining, by means of which the carbon dioxide will be completely dissipated.

Description and Tests.—The *U. S. P.* describes lime as "hard, white, or grayish-white masses, which, in contact with air, gradually attract moisture and carbon dioxide, and fall to a white powder; odorless, of a sharp, caustic taste. Soluble in about 750 parts of water at 15° C. (59° F.), and in about 1300 parts of boiling water; insoluble in alcohol. Soluble in diluted acetic, hydrochloric, or nitric acid. When sprinkled with about half its weight of water, lime becomes heated, and is gradually converted into a white powder (calcium hydrate or slaked lime). When this is mixed with about 3 or 4 parts of water, it forms a uniform, smooth magma (milk of lime). Even at the highest degrees of heat, lime remains unaltered and does not fuse. Its aqueous solution gives an intensely alkaline reaction with litmus paper"—(*U. S. P.*).

Lime, when pure, is a white or grayish solid, moderately hard, but easily reduced to powder, and having a specific gravity of about 3.08. It has a hot, burning, alkaline taste, in some measure corrodes and destroys animal tissues, reacts powerfully on vegetable colors as an alkali, and is difficult of fusion, requiring the oxyhydrogen flame to both fuse and volatilize it. A pint of water at 0° C. (32° F.), dissolves 13.25 grains of lime; at 100° C. (212° F.), it dissolves only 6.7 grains. The dense fluid termed *milk of lime*, is slaked lime suspended in lime water. When water is added to lime, this swells up, cracks, and becomes reduced to powder, with the evolution of a considerable degree of heat; in this state it is called *slaked lime* (*calx extincta*), or the *hydrate of lime* (*calcis hydras*), *milk of lime* (*hydroxide of calcium*). It is white, pulverulent, much less caustic than lime, and is principally used for preparing chlorinated lime. On exposure to the air it falls to white powder known as "air-slaked lime." Its ashen-gray color is due to impurities present in the stone from which it is prepared. When perfectly pure it is a white compound. When heated in an oxyhydrogen flame it emits an intensely brilliant white light, and when the flame of the oxyhydrogen blow-pipe is directed upon a small piece of quicklime the *oxy-hydrogen-calcium light* is produced, and when the oxygen gas is first passed through an alcohol lamp flame, a less brilliant light (the *oxy-calcium light*), is the result. These lights are used for stereopticon exhibitions and for theatrical stage-effects. Lime is one of the alkaline earths, differing from the others in forming an exceedingly deliquescent salt with chlorhydric acid (calcium chloride), and one practically insoluble with sulphuric acid (calcium sulphate).

In 1808, Davy showed that lime was an oxide of calcium. Lime is soluble in hydrochloric acid without effervescence, and the solution gives no precipitate with ammonia. Lime-water reddens yellow turmeric paper, turns infusion of red cabbage green, is rendered milky on the addition of carbon dioxide; forms a white precipitate with oxalic acid or an oxalate, and gives no precipitate with sulphuric acid. "It enters very readily into combination with all the acids, sulphur, and phosphorus, and decomposes the alkaline carbonates, phosphates, fluorides, borates, oxalates, tartrates, and citrates; the ammoniacal acetates, chlorides, and succinates, the sulphates of aluminum and magnesium; the metallic salts, spirituous liquors, and astringent substances" (Coxe). Consequently the above are incompatibles. "Its solution in diluted acetic acid gives, with ammonium oxalate T.S., a white precipitate insoluble in acetic acid, but soluble in hydrochloric acid. If 1 part of lime be slaked and then thoroughly mixed with 50 parts of water, and the greater portion of the milky liquid decanted, no hard, gritty particles should be found in the residue, nor should the addition of hydrochloric acid to this residue cause much effervescence (limit of carbonate), nor leave more than a slight insoluble residue. If the decanted portion be dissolved in acetic acid and filtered if necessary, a portion of the filtrate should not be rendered turbid by potassium dichromate T.S. (absence of barium). In another portion of the filtrate, the addition of the ammonia water should not produce more than a slight turbidity (limit of aluminum, etc.)"—(*U. S. P.*).

Laboratory and Pharmaceutical Uses.—Lime is employed to dry gases and to abstract water from alcohol and ether when concentration free from moisture is desired. It forms, under certain conditions, insoluble salts with many acids, *e. g.*, carbonic, phosphoric, and citric acids; hence, it is useful, not only in the preparation of alkaline compounds, as, for example, caustic potash or soda, and alkaloidal products, and certain other principles (santonin, etc.), but also of organic acids (citric acid, tartaric acid, etc.). It is used in making precipitated sulphur (milk of sulphur); in preparing liquor calcis, potassium chlorate, and especially sodium carbonate according to Leblanc's process, and many other chemical materials.

Action and Medical Uses.—Unslaked lime disintegrates animal and vegetable tissues, favoring their solution, and with albumen forms a horn-like substance. Its use by tanners to remove cuticle and hair from hides is well known. It is not so energetic a caustic as the alkalies on account of the fact that it has not so great an affinity for water. Internally, it may act as a violent gastro-intestinal poison. Diluted acids will antidote it. For its internal employment, see *Liquor Calcis.* Externally it is a powerful escharotic. It is generally employed with other agents. *Potassa cum calce*, a powerful caustic for cauterizing the neck of the uterus, or other parts, and also known as *Vienna powder* or *paste*, is made by reducing caustic potash 1½ ounces, and quicklime 2 ounces, each separately, to powder in a heated mortar; then mix them carefully and rapidly, and keep the mixture in a wide-mouthed bottle with a ground stopper. In using this caustic, the powder must be moistened with a little alcohol, so as to reduce it to a soft paste, which is to be applied to the part to be cauterized. In this case the potassa only acts upon a circumscribed portion of skin, instead of spreading, as common caustic potash generally does; but to bound the space still more accurately, it may be surrounded by a ring of diachylon plaster; vinegar will neutralize its action. This caustic is sometimes made with equal parts of the two articles forming it. It is also prepared in sticks. Dr. Filhos has prepared a caustic of the same agents, which is more easily used; it is called the *Caustic of Filhos.* It is made by fusing together 6 ounces of caustic potash, and 3 ounces of quicklime; the mixture is poured into leaden cylinders inclosed in glass tubes, and which are to be sealed afterward at each end. *London paste*, also used as a caustic for destroying abnormal growths, is made by making a pasty mass with equal parts of caustic soda and unslaked lime, and a sufficient quantity of absolute alcohol; it should not be allowed to remain in contact with the parts more than 5 or 6 seconds. It has been especially recommended for the removal of *enlarged tonsils*.

In cases where diaphoresis is desirable, without disturbing the patient, it may be effected as follows: Take a piece of lime about the size of a Sicily orange, and wrap around it a wet rag, but not too wet; around this wrap several thicknesses of dry muslin or cloth. Place one thus prepared on each side of the patient, and by both thighs; it will soon induce copious perspiration.

Lime is freely used to *arrest putrefaction* in cesspools, slaughter-houses, dissecting rooms, drains, vaults, sewers, etc., and to disinfect the stools in infectious diseases.

Related Preparation.—CALCII HYDRAS. *Calcium hydroxide, Calcium hydrate, Slaked lime, Hydrate of lime, Calcaria hydrica.* Formula: $Ca(OH)_2$. Molecular weight: 73.83. When lime is gradually treated with about one-third of its bulk of water it unites with it to form slaked lime under evolution of much heat. So intense is this heat that fires are said to have resulted from it. For the preparation of this compound the *British Pharmacopœia* directs 2 pounds of lime and 1 pint (Imp.) of distilled water. Introduce the lime into a metallic pot, pour upon it the water, and when vapors cease to arise, cover and set aside to cool. When reduced to the atmospheric temperature, transfer the slaked lime to a wire sieve, and gently agitate to allow the finer particles to pass, rejecting that which remains in the sieve. Keep the powder away from the air by putting it in closely-stoppered bottles. Slaked lime is a pure white powder, strongly alkaline in reaction and taste, and soluble in acids without much effervescence, if but little carbonate is present. A dull, red heat renders it perfectly anhydrous without previous fusion. On exposure to the atmosphere it absorbs carbon dioxide, and forms calcium carbonate. "One hundred parts of water at 15.6° C. (60° F.), dissolve 0.1368 parts, and at 100° C. (212° F.), only dissolve 0.0752 parts." Its solution is known as lime-water (see *Liquor Calcis*). When quicklime is slaked, or when slaked lime is made into a thin paste with 3 or 4 parts of water, it forms *milk of lime*, a preparation considerably employed in chemical manipulations, and as "*white wash*" for ceilings. For uses see *Liquor Calcis* (see also above).

CALX CHLORATA (U. S. P.)—CHLORINATED LIME.

"A compound resulting from the action of chlorine upon calcium hydrate, and containing not less than 35 per cent of available chlorine. This preparation is often improperly called 'chloride of lime.' Chlorinated lime should be kept in well-closed vessels, in a cool and dry place"—(*U. S. P.*).

SYNONYMS: *Chloride of lime, Bleaching powder, Hypochlorite of calcium, Calx chlorinata, Calcaria chlorata.*

Preparation.—This compound is made essentially on the same principle as when first prepared by Tennant and Knox at the close of the last century. It is prepared by passing thoroughly dried and perfectly slaked lime through a sieve, and spreading the powder so produced upon trays arranged tier upon tier, in proper chambers or boxes. Upon these trays a stream of chlorine gas is directed from the top until the slaked lime has absorbed all the gas it will take up. Care should be taken to prevent a temperature above 25° C (77° F.), so as to guard against the formation of chlorate of calcium ($Ca[ClO_3]_2$). It may be prepared so as to contain *available chlorine* (see below) to the amount of 43 per cent. The reaction involved is as follows: $Ca(OH)_2+Cl_4=Ca(ClO)_2+CaCl_2+2H_2O$. The compound formed is looked upon by some as being a mixture of calcium hypochlorite and calcium chloride ($Ca[ClO]_2+CaCl_2$), by others as being a definite compound, $CaCl(OCl)+H_2O$. The improvements in this process have consisted mainly in the introduction of new methods in the manufacture of the chlorine gas. Efforts are being made, for example, to obtain chlorine gas on a manufacturing scale by electrolysis of chloride of potassium or of the chlorides of heavy metals, such as zinc or copper. For an interesting historical résumé of the progress made in the manufacture of chlorine gas, see paper by L. Mond, read before the B. A. A. S., 1896 (*Pharm. Jour. Trans.*, 1896, p. 282).

Description and Tests.—The Pharmacopœia describes chlorinated lime as follows: "A white, or grayish-white, granular powder, exhaling the odor of hypochlorous acid, having a repulsive, saline taste, and becoming moist and gradually decomposing on exposure to air. In water or in alcohol it is only partially soluble. The aqueous solution first colors red litmus paper blue, and then bleaches it.

If the salt be dissolved in diluted acetic acid, an abundance of chlorine gas is evolved, and only a trifling residue left undissolved. From this solution ammonium oxalate T.S. throws down a white precipitate insoluble in acetic acid, but soluble in hydrochloric acid. If 0.35 (0.354) Gm. of chlorinated lime be thoroughly triturated with 50 Cc. of water and carefully transferred, together with the washings, into a flask, and then 0.8 Gm. of potassium iodide and 5 Cc. of diluted hydrochloric acid added, the reddish-brown liquid, mixed, toward the end of the titration, with a few drops of starch T.S., should require for complete decoloration, not less than 35 Cc. of decinormal sodium hyposulphite V.S. (each cubic centimeter corresponding to 1 per cent of available chlorine)"—(*U. S. P.*).

Much of the commercial product contains from 20 to 35 per cent of available gas. Chlorinated lime decomposes even when preserved in close containers, and it is recorded that explosions have occurred when so secured. Even carbonic acid gas slowly decomposes this compound with the liberation of hypochlorous acid ($ClOH$). Oxygen is evolved from its solution in water when mixed with black oxide of manganese, and other oxides. It has active decolorizing properties. Excessive moisture indicates the presence of calcium chloride, and the amount of lime in excess may be approximately determined by its degree of solubility.

By the term *available chlorine*, is understood the amount of chlorine gas which is evolved by bringing chlorinated lime into contact with acids in excess, *e. g.*, sulphuric acid, according to the following equation: $CaOCl_2+H_2O+H_2SO_4=CaSO_4+2H_2O+2Cl$. Hydrochloric acid would effect a similar decomposition, the only difference consisting in the formation of calcium chloride instead of sulphate.

The amount of *available chlorine* in calx chlorata may be determined in various ways. By the *U. S. P.* process (see above), the available chlorine liberates iodine from potassium iodide in acid solution according to the equation: $2KI+Cl_2=2KCl+2I$. The iodine is then determined by titrating with decinormal volumetric solution of sodium hyposulphite. Another method is that based upon the oxidation of arsenous acid to arsenic acid in alkaline solution by chlorinated lime. A known quantity of a decinormal solution of arsenous acid in excess being employed, this excess is determined by titration with decinormal iodine volumetric solution, starch test solution being used as an indicator. The following formulæ express the principle of this reaction: $As_2O_3+4Cl+2H_2O=As_2O_5+4HCl$, and $As_2O_3+4I+2H_2O=As_2O_5+4HI$.

The *U. S. P.* (1880) demanded a strength of at least 25 per cent, by weight, of available chlorine, which standard was raised to 35 per cent in the 1890 edition. The *French Codex* demands a minimum strength of 90 chlorometric degrees, a degree (established by Gay-Lussac), denoting the number of liters of chlorine gas (reduced to a temperature of 0° C. [32° F.], and the normal atmospheric pressure of 760 Mm.), evolved from 1 kilogram of chlorinated lime. A simple calculation shows 90 such degrees to be equivalent to 28.63 per cent of available chlorine.

Uses in Pharmacy and the Arts.—Chlorinated lime is largely used for its decolorizing action upon organic materials, its solutions, especially in the presence of acids, being powerful bleaching agents. It is employed in pharmacy in the making of chloroform, and the official solution of chlorinated soda (Labarraque's solution), which, as well as chlorinated lime itself, is an excellent deodorizer and disinfectant.

Action, Medical Uses, and Dosage.—Chlorinated lime partakes of the properties of both lime and chlorine, the most valuable constituent being the latter. Large doses produce gastric heat with nausea, vomiting, and purgation. Even moderate doses produce gastro-intestinal irritation. Externally applied, it is actively irritant, and may act as a feeble caustic. In lesser quantities it is dessicant, and counteracts gangrenous manifestations. Internally, chlorinated lime has been of considerable service in *scrofulous affections*, *mesenteric glandular enlargements*, and to control and modify the profuse and purulent secretions in *phthisis* and *bronchitis*, where it may also be used as a spray, and as a remedy in such adynamic states as *low fevers*, *typhus*, *typhoid dysentery*, and particularly in *typhoid fever*, where it is asserted to quiet delirium, moisten and cleanse the foul, dry tongue, and stimulate the dormant cutaneous functions. Externally, it is a stimulant to various indolent disorders, and a remedy for the *itch*. *Purulent ophthalmia*, *gonorrhœa*, *gangrenous*, *scarlatinal*, and *scorbutic ulcerations* of the mouth *burns, frostbites, ulcerated gums, putrid sore throat*, and *indolent syphilitic ulcers*, are all improved by a wash of from 20 to 40 grains to the ounce of water. It removes the foul odors arising from *retained placenta*, uterine and other *carcinomata, fetid feet* and *axillæ, ozena*, and *foul breath* due to mercurialization or to altered secretions from the tonsils and faucial glands. For *ulcers*, 4 drachms of the powder may be added to 1 ounce of lard; for *glandular enlargements*, add 1 drachm.

Chlorine is probably the best general germicide known, and chlorinated lime, which evolves it slowly, should be used in sick rooms as a disinfectant. Place it in the vessels into which septic and infectious sputa, and alvine discharges are passed. A little of the powder may also be placed in a saucer and moistened with water, or cloths may be saturated with a solution of it, and hung up in the room for general disinfecting purposes. Like chlorinated soda and its solution, it may be used to deodorize and disinfect vaults, sewers, dissecting rooms, and dead bodies preserved for police investigations should be wrapped in sheets dipped in saturated solutions of this compound. Chlorine, though an active germicide, does not exert its force readily when objects are dry, but in the presence of moisture its action is decidedly energetic. Therefore, in using bleaching powder, steam should also be generated in the room, that the chlorine may better attack the offenders. When it is desired to disinfect unoccupied rooms after sickness or death, a saturated solution of bleaching powder may be placed in the steam-moistened room, and a little sulphuric acid added to the solution, and the room closed. Care should be taken not to inhale the chlorine gas, which is rapidly liberated. The person should get out of the room as soon as possible after adding the acid.

For external use a solution prepared by adding 20 to 40 grains to 1 fluid ounce of water; for internal use the dose should be from ½ to 4 grains, largely diluted with water, and sweetened if desired. For disinfecting purposes, use a saturated solution.

Specific Indications and Uses.—Bad breath and pallid, dirty tongue, with pasty coat, lymphatic glandular enlargements, and slow inflammations with cacoplastic deposits; inflammation of cellular structures with tendency to sloughing. Add calx chlorata, ℥j to aqua Oj. Filter. Dose, 10 to 30 drops, largely diluted (Scudder).

CALX SULPHURATA (U. S. P.)—SULPHURATED LIME.

"A mixture containing at least 60 per cent of calcium monosulphide (CaS=71.89), together with unchanged calcium sulphate ($CaSO_4$=135.73), and carbon, in varying proportions"—(*U. S. P.*).

SYNONYMS: *Crude calcium sulphide, Hepar sulphuris calcareum, Hepar calcis,* and improperly as *Monosulphide*, or *Sulphide of calcium.*

Preparation.—This salt, which is usually called calcii sulphidum, or sulphuret of lime, is obtained by heating sulphate of calcium with powdered charcoal, or by passing a mixture of carbon dioxide and the vapor of carbon disulphide over incandescent lime (Schoene); or, by calcining calcium monoxide (lime) or calcium carbonate, with powdered sulphur. In the latter case calcium sulphate is also formed. The following directions are given by Wittstein: "Three parts of finely powdered crystallized sulphate of calcium (native gypsum), are intimately mixed with 1 part of finely powdered wood charcoal, the mixture is well pressed into an earthen or black lead crucible, covered with a thin layer of charcoal powder, and then the cover luted, with the exception of a very small opening on the top; when the luting is dry, heat is applied, at first gently, and afterward strongly, in a good wind furnace for at least 1 hour. When cooled, the crucible is removed from the fire, the upper portion of its contents taken off, the remainder powdered in a mortar, and kept in a well-closed vessel. The yield is nearly 1½ parts." The following is the *U. S. P.* formula: "Dried calcium sulphate, in fine powder, seventy grammes (70 Gm.) [2 oz. av., 205 grs.]; charcoal, in fine powder, ten grammes (10 Gm.) [154 grs.]; starch, two grammes (2 Gm.) [31 grs.]. Mix them thoroughly, pack the mixture lightly into a crucible, cover this loosely, and heat it to bright redness, until the contents have lost their black color. Allow the crucible to cool, reduce the product to powder, and at once transfer to small, glass-stoppered vials"—(*U. S. P.*).

Description.—Pure calcium monosulphide (formula, CaS; molecular weight, 71.89) forms a white mass, almost insoluble in water, to which, however, it gives an alkaline reaction and hepatic taste. As usually prepared, it inclines toward a gray or red tint, from iron or manganese contained in the materials, or (gray) from the presence of unconsumed charcoal. In moist air it is slowly decomposed, evolving sulphide of hydrogen. The final result of the action of the atmosphere is complete decomposition of the calcium monosulphide, with formation of calcium carbonate ($CaCO_3$), calcium sulphate ($CaSO_4$), and free sulphur. It is essential, therefore, that the salt be either freshly prepared, or else carefully preserved in glass-stoppered bottles, which should be nearly filled. The following describes crude calcium sulphide (calx sulphurata) and gives the tests of the *U. S. P.*: "A pale-gray powder, exhaling a faint odor of hydrogen sulphide, having a nauseous, alkaline taste, and gradually decomposed by exposure to air. Very slightly soluble in cold water, more readily in boiling water, which partially decomposes it; insoluble in alcohol. Sulphurated lime is decomposed by diluted acetic acid, and converted into calcium acetate and hydrogen sulphide gas which escapes, while a residue of calcium sulphate remains. The filtrate from this yields, with ammonium oxalate T.S., a white precipitate insoluble in acetic acid, but soluble in hydrochloric acid. If 1 Gm. of sulphurated lime be gradually added to a boiling solution of 2.08 Gm. of cupric sulphate in 50 Cc. of water, the mixture digested on a water-bath for 15 minutes, and filtered when cold, no color should be imparted to the filtrate by 1 drop of potassium ferrocyanide T.S. (presence of at least 60 per cent of pure calcium monosulphide)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Calcium sulphide is a valuable remedy on account of its power over cellular and cutaneous inflammations, with suppuration or tendency to suppurate. Not only does it influence glandular and lymphatic structures, proving a good remedy in *suppurative adenitis*, but it undoubtedly has some control over the body fluids, such as to prevent suppuration from inflammations of the soft structures. In cases tending to the formation of pus, resolution will take place if the condition be recognized early enough and the drug administered; if past the stage for resolution suppuration will be hastened by it, though the amount of broken-down tissue and consequent quantity of purulency will be less than if the suppurative process proceeded without its aid. It is the best antisuppurative known when the condition is not due to syphilis, and even in the secondary stage of the latter it is not without good effects, but other agents, notably berberis aquifolium, are regarded more efficient. The mucous surfaces (the internal integuments) are also influenced by it, and suppurative action checked as in the purulent stages of *bronchitis* and *pneumonia*. It is a well-established remedy for certain forms of *nasal catarrh*—those in which secretion is abundant with a tendency toward purulency, and where the patient readily takes repeated colds. In this condition the 2 x trituration is to be preferred. It is a remedy in *chronic pharyngitis* and in *diseases of the larynx*, with impairment of voice; also after *pneumonia*, where small suppurative points or deposits linger in the wake of the disease. Prof. Locke (*Syllab. Mat. Med.*) commends it in the *cough of phthisis* following *syphilis*. In *chronic skin diseases* it is adapted where the epidermal tissues undergo a change, and also in those forms in which *suppurative pimples* form. *Eczema*, in scrofulous subjects, is amenable to it, and, while it tends to check suppurative action in *acne*, it does not always check the disease. As a remedy for successive crops of *boils* no agent is superior, though alnus is a close second.

Sulphide of calcium, in order to be of therapeutical value, must possess the odor peculiar to sulphides, which is very similar to that of rotten eggs. This remedy is particularly valuable in *boils*, *carbuncles*, *suppurating scrofulous ulcers* in the neck, *scrofulous sores*, *soreness of the throat* with glandular enlargement, occuring in *measles* or in *scarlatina*, *enlarged testes*, *indolent* and *suppurative buboes* and *soft chancres*, *acne*, *mammary abscess*, *anal fistula*, etc. Its influence on the suppurative process, as stated by Prof. S. Ringer, is as follows: A thin, watery, unhealthy discharge, becomes, at first, more abundant, then diminishes, and becomes thicker and healthier, like "laudable" pus, the condition of the sore improving correspondingly, and its healing being promoted. In some cases, any pain that exists is temporarily aggravated, but, as a rule, it is speedily mitigated. The general health improves, and the debility and malaise, so frequently attending these maladies, promptly passes away. In cases where inflammation and severe pain are present, he advises the smearing of the parts with a mixture of equal parts of belladonna extract and glycerin, covering this with a small poultice, at the same time protecting the surrounding skin from the tendency of the poultice toward the production of a fresh crop of boils, etc., by the application of a piece of leather with a hole in it large enough to contain the boil or affected portion. The dose varies from $\frac{1}{10}$ grain to $\frac{1}{2}$ grain, every 2 or 3 hours, and the treatment requires to be continued for several weeks. Ordinarily $\frac{1}{6}$ of a grain rubbed up with 2 or 3 grains of sugar of milk, will be a sufficient dose. Dr. S. Sexton, of New York, and others have derived much benefit from sulphide of calcium in cases of *furuncular inflammation of the external meatus auditorius*, when suppuration was threatened, or had already occurred. Foltz gives 1 grain of the 1 x or 2 x trituration to prevent suppuration in *acute otitis media*, and continues its use if suppuration becomes established. He uses it also (1 grain of 1 x or 2 x trituration, every 3 hours) in *dacryo-cystitis*, in crops of *styes*, which it will generally prevent, *ciliary blepharitis*, with tendency to pustulation, and declares it *the* drug in *suppurative affections* of the cornea, conjunctiva, and deeper eye structures (*Dynam Therap.*) Dr. Solomon, of Birmingham Hospital, England, has found the sulphide of calcium efficient in cases of *chronic vascular keratitis* (strumous), when accompanied with cold extremities and other indications of impaired circulation; he dissolves 1 grain of the sulphide in $\frac{1}{2}$ pint of water, and administers the solution in doses of from 1 to 4 fluid drachms, repeated every 2, 3, or 4 hours. In acute cases, he has found it injurious, and, in patients of a sanguine temperament, it acts as a stimulant. In doses of $\frac{1}{8}$ of a grain, rubbed up with 3 grains of sugar of milk, and repeating the dose 3 or 4 times daily, this agent is reported to have been successful in the treatment of *diabetes;* but further experiments are required before much confidence can be placed in this statement. Larger doses of the sulphide of calcium than those stated above, are apt to derange the digestive functions; with children they should be less.

The dose of calcium sulphide ranges from $\frac{1}{20}$ to 2 grains; many, however, prefer 2 to 5-grain doses of the 1 x or 2 x trituration, given every 2 or 3 hours. Calcium sulphide gives the best results in chronic cases, and a disagreeable feature of its administration is the eructation of sulphuretted hydrogen, the drug being decomposed in the stomach.

Specific Indications and Uses.—Inflammation of areolar or connective tissue, with tendency to suppuration; to prevent suppuration, or to hasten it after once established, thus saving extensive tissue destruction; successive crops of boils or styes; pustular eruptions; lymphatic torpor, with tendency to purulency; feeble recuperative powers after exhaustive purulent diseases; suppuration of the ear or eye and appendages; purulent catarrhal states; scrofula and struma.

Related Compounds and Preparations.—CALCII OXYSULPHURETUM.—This is *sulfure de calcium* of the French, and is a mixture of oxysulphide and sulphate (or thiosulphate) of calcium, in variable proportions. It occurs in grayish-green or gray masses, and should be securely kept in glass-stoppered vials. It is prepared by boiling, with frequent stirring, calcium hydroxide (300 parts), sulphur (100 parts), and water (500 parts). When of the proper consistence to solidify, it is poured upon a slab of marble until cool, when it is at once transferred to bottles.

MARTIN'S DEPILATORY.—When a current of hydrogen sulphide is passed into a mixture of calcium hydroxide (2 parts) and water (3 parts), until no more will be absorbed, a semi-solid mass of pronounced sulphurous smell, and known by the foregoing name, is produced. Its depilatory action is so perfect that but a very few moments' application suffices to remove the hair. Upon standing it is separated into 2 parts which, before using, must again be mixed. This preparation contains calcium hydrosulphide ($Ca[HS]_2$).

CAMBOGIA (U. S. P.) GAMBOGE.

"A gum-resin obtained from *Garcinia Hanburii*, Hooker filius"—(*U. S. P.*). (*Garcinia Morella*, Desrousseaux, var. *pedicellata*, Hanbury).

Nat. Ord.—Guttiferæ.

COMMON NAMES: *Gamboge, Camboge, Gutti, Gummi-resina gutti, Cambodia, Gutta gamba.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 33.

Botanical Source and History.—This plant differs from that of *Garcinia Morella* (*G. pictoria*), described below, in having *pedicellate* male flowers. It has glossy leaves resembling those of the laurel, and bears yellow flowers.

Gamboge was first brought to Europe by Admiral Van Neck, in 1603, who gave a specimen of it to Prof. Clusius, of Leyden (*Amer. Jour. Pharm.*, 1837). In relation to the plant from which this gum-resin is derived, there was formerly much confusion. By some it was laid down as coming from *Stalagmitis cambogioides*, upon the authority of Murray, but Dr. Graham has satisfactorily determined that there is no such plant in existence. It was then supposed to be derived from trees of Ceylon, which produce gum-resins agreeing closely or entirely with the official gamboge (the *Garcinia Cambogia* and the *Hebradendron cambogioides*, which last was supposed to be the tree from which it was principally collected), though on merely presumptive evidence. The latter tree is not now recognized under the name *Hebradendron*, but is regarded by botanists as identical with *Garcinia Morella* of Desrousseaux. Hanbury also regards the *G. elliptica*, Wallich, as identical, the product of which is certainly identical with commercial gamboge. The matter was best presented by Mr. Hanbury, who investigated the subject, finding that the gum was the product of a variety of the above mentioned *Garcinia Morella* of Desrousseaux (*Garcinia pictoria*, Roxburgh; *Hebradendron cambogioides*, Graham), and to that variety he gave the name *Garcinia Morella*, var. *pedicellata*, on account of its pedicellate, male flowers. The younger Hooker, however, regarded it as sufficiently distinct from the *Garcinia Morella* to entitle it the rank of a species, and accordingly gave it the title, *Garcinia Hanburii* (see Hanbury, "On the species of Garcinia which affords Gamboge in Siam," *Tr. Linn. Soc.*, Vol. 24, p. 487).

The *Garcinia Morella*, Desrousseaux, is a moderate-sized tree, with opposite petiolate, obovate-elliptical, coriaceous, smooth, entire, abruptly-acuminate, shining leaves, which are dark-green above and paler beneath. The flowers are unisexual, sessile, and axillary; the calyx membranous and persistent, consisting of 4 sepals; the corolla is 4-petaled, while the fruit is a pleasant, saccharine, quadrilocular berry, about the size of a cherry, crowned with a sessile stigma, containing 1 seed in each division (L.). In order to obtain the gum-resin incisions are made into the tree, or a large slice is pared from the bark, from which the juice flows thick, viscid, and bright-yellow, which is scraped off and dried in the sun. If left on the tree, it speedily concretes into dry tears or irregular masses. It is more generally collected, however, by making incisions into the bark, into which bamboo joints are inserted to catch the oozing fluid, which subsequently solidifies. It is removed from the bamboo by slowly rotating them over a fire until the water has dried out sufficiently to allow the receptacle to be detached from the hardened gamboge. The first process described is that by which the Ceylon gamboge is collected. The best kinds are the *pipe gamboge* and *Ceylon gamboge*, which last is seldom found in our country. The pipe gamboge consists of cylindrical pieces, often cohering together, forming irregular masses weighing several pounds. *Lump* or *cake gamboge* occurs in masses of several pounds weight; it differs from the best pipe gamboge in containing between 5 and 10 per cent of starch, and fragments of wood, twigs, and air cells. Gamboge is used in painting as a yellow pigment, known in Europe as *gummigutt*. It is collected in Siam and Cochin-China, and principally in Cambodia, and sent to Singapore, Saigon, and Bangkok, from which places it is imported into this country.

Description.—Gamboge, to meet the official demands, should conform to the following description and tests: "In cylindrical pieces, sometimes hollow in the center, 2 to 5 Cm. (¾ to 2 inches), in diameter, longitudinally striate on the surface; fracture flattish-conchoidal, of a waxy luster, orange-red; in powder bright yellow; inodorous; taste very acrid; the powder sternutatory. Gamboge is partly soluble in alcohol and in ether. When triturated with water it yields a yellow emulsion, and forms, with solution of potassium or sodium hydrate, an orange-red solution, from which, on addition of hydrochloric acid, a yellow resin is precipitated. Boiled with water, gamboge yields a liquid which, after cooling, does not become green with iodine T.S. (absence of starch)"—(*U. S. P.*). Ether and water when used alternately, dissolve the whole of pure gamboge. Alcohol dissolves all the resin, leaving the gummy matter, and ammoniated alcohol forms a solution with it which is not changed by water.

Chemical Composition.—Gamboge consists mainly of resin (71.6 to 74.2 per cent), gum (21.8 to 24 per cent) moisture (4.8 per cent), traces of starch and woody fiber (Christison). The resin has the nature of an acid (*gambogic acid*), and is the active principle of the gum. Its specific gravity is 1.221. It forms soluble salts with alkalies, and insoluble precipitates with salts of heavy metals; this class of compounds has been called *gambogiates*. The resin is obtained by extracting gamboge with ether (whereby the gum is left behind), and evaporating the solution to dryness. It occurs in brittle masses of a deep orange color, insoluble in water, but soluble in alcohol, ether, chloroform, carbon disulphide, and caustic alkali, with which it forms an orange-red solution, from which acid again precipitates the yellow resin. Gambogic acid imparts a perceptible yellow hue to 10,000 times its weight of spirit or water (C.).

Pereira gives the following as the tests for distinguishing gamboge: "Gamboge emulsion becomes transparent and deep-red on the addition of potassa, forming *gambogiate of potassium*. Digested in alcohol or ether, gamboge yields orange-red tinctures (*solutions of gambogic acid*). The ethereal tincture dropped on water yields, on the evaporation of the ether. a thin, bright-yellow, opaque, film or scum (*gambogic acid*), soluble in caustic potash. The alcoholic tincture dropped into water, yields a bright, opaque, yellow emulsion, which becomes clear, deep red, and transparent, on the addition of caustic potash. The gambogiate of potassium (obtained by any of the above processes), gives, if the alkali be not in excess, with acids, a yellow precipitate (*gambogic acid*); with acetate of lead, a yellow precipitate (*gambogiate of lead*); with sulphate of copper, brown (*gambogiate of copper*); and with the salts of iron, dark brown (*gambogiate of iron*)."

Hlasiwetz and Barth (1866), in fusing the purified resin of gamboge with potassium hydroxide, obtained several acids, among them *acetic*, *pyro-tartaric* ($C_5H_8O_4$), and *isuvitinic* ($C_6H_4CH_2[COOH]_2$) acids; also *phloroglucin* ($C_6H_3[OH]_3$). The vapor given off during fusion had the odor of balm and lemons. The presence of wax has also been indicated by Hurst, in 1889 (Flückiger).

Action, Medical Uses, and Dosage.—In large doses gamboge is a powerful irritant, causing gastro-enteritis and death; it is said to produce diffuse inflammation of the cellular tissue, when applied beneath the skin. On account of its severity of action, and its liability to cause serious symptoms, it is seldom employed singly as a purgative; yet when combined with other cathartics it forms a safe and excellent physic. It may, however, be safely administered alone in moderate doses, by reducing it to a state of fine division with other comparatively inert powders, as sulphate or bitartrate of potassium. It thus operates effectually as a hydragogue, without occasioning much tormina or constitutional exhaustion. In medicinal doses, it is a drastic, hydragogue cathartic, causing nausea, griping, and copious watery stools, on which account it is often used in *dropsy*, in combination with squills, cream of tartar, etc. It has also been used for the expulsion of *tapeworm*, in *torpor of the bowels*, *dysmenorrhœa*, etc. Two grains of sulphate of quinine combined with 1¼ grains of gamboge, and administered 3 times a day, have been highly recommended in cases of long-continued *constitutional debility*, with constipation. United with an alkali, it proves diuretic.

Its use is contraindicated in gastritis, enteritis, during pregnancy, menorrhagia, hemorrhoids, in excited, irritable, or diseased uterus, and where there is irritation or disease of the urinary organs. When taken in large doses, or when it acts with severity, the best remedy to counteract its dangerous effects is a solution of some alkaline substance, as sodium bicarbonate, to be followed by general treatment if inflammatory symptoms be present. Dose, in pill, powder, or alkaline solution, from 1 to 15 grains; the larger doses given in small quantities, and repeated at short intervals until it operates.

CAMPHORA (U. S P.)—CAMPHOR.

FORMULA: $C_{10}H_{16}O$. MOLECULAR WEIGHT: 151.66.

"A stearopten (having the nature of a ketone) obtained from *Cinnamomum Camphora* (Linné) Nees et Ebermaier, and purified by sublimation (*U. S. P.*); (*Laurus Camphora*, Linné; *Camphora officinarum*, C. Bauhin)."

Nat. Ord.—Laurineæ.

COMMON NAMES: *Laurel camphor.* (Tree) *Camphor laurel.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 222.

Botanical Source.—The Cinnamomum Camphora is a large tree with lax, smooth branches. The leaves are evergreen, alternate, on long, slender, smooth petioles, somewhat coriaceous, oval, acuminate, attenuate at the base, bright-green and shining above, paler beneath, triple-nerved, with a sunken gland at the axils of the principal veins, projecting at the upper side and opening by an oval pore beneath. The flowers are small, smooth, yellowish-white, in axillary and terminal, naked corymbose panicles. The leaf-buds are scaly. The fertile stamens are 9 in 3 rows; the inner with 2, compressed, stalked glands at the base; the anthers 4-celled; the outer ones turned inward; the inner ones outward. Three sterile stamens are placed in a whorl alternating with the stamens of the second row; 3 others are stalked, with an ovate glandular head. The fruit is placed on the obconical base of the calyx (L.).

History.—Camphor, obtained from the *Cinnamomum Camphora*, and, in the crude state, is imported into this country, principally from Canton, where it undergoes purification by sublimation, before it is in a state adapted to medicinal use. The camphor tree inhabits the eastern and warmer latitudes of Asia. It thrives in warm countries and is cultivated by the Italians for ornamentation. It is an aromatic tree, all parts of it yielding the odor and giving the taste of camphor. Camphor is obtained in Japan by cutting the wood, roots, etc., of the tree in small pieces, boiling them in water, in large iron stills, fitted with earthen heads, containing straw cones. The water is kept boiling for about 48 hours, the camphor sublimes and concretes upon the straw in the head, in the form of a gray powder. It appears in commerce as whitish, dry, granular cakes, slightly tinged with red, and is known as *Japan camphor*, or *Tub camphor*, on account of being imported in a double tub. It was once commercially known as *Dutch camphor*. The Chinese pursue a different process. They steep the chopped branches in water, then boil it, continuing the ebullition until a stick placed in the fluid will, when cooled, be covered with the camphor. The liquor is then strained, and by cooling, the camphor solidifies. This is then placed alternately in layers, with powdered dry earth, in a copper vessel, over which another one is placed, and the camphor, being sublimed by heat, attaches itself to the upper inverted vessel. It is of a dirty grayish color, and is known as impure or crude camphor. Though prepared by the Chinese and known as Chinese camphor, it is manipulated in Formosa. None is made in China. It sometimes appears in the market like the preceding in appearance, but oftener of a darker hue, in smaller particles, and in a moist condition. It is packed in chests, covered inside with sheet-lead or tin, and is known as *Chinese camphor*, or *Formosa camphor*. In Formosa, camphor is also prepared by allowing the camphorated steam to collect on earthen receivers placed over the vaporizing troughs. Camphor is now refined in this country. Vessels similar to the *bombaloes* of Europe (large globular glass vessels), are sometimes used, differing, however, from the European apparatus in being made in sections, so that they can be readily taken apart and the camphor removed. To remove the sublimate from the *bombaloes* (of Europe) the latter must be broken. It may also be sublimed slowly and cautiously from retorts into a receiving chamber, as "*flowers of camphor*," a fine crystalline state which, by powerful pressure, may be made to form cakes. Japan, since the acquisition of Formosa, now has a monopoly of Chinese camphor.

The camphors are closely related to the different varieties of turpentine. Two species are known in the East, viz.: *Borneo camphor* ($C_{10}H_{18}O$), obtained from a very large tree, the *Dryobalanops Camphora*, Colebrooke, which is so highly prized by the natives that it rarely finds its way to our markets; and the *Laurel camphor* ($C_{10}H_{16}O$), from the *Cinnamomum* (*Laurus*) *Camphora*, and which is the ordinary camphor of commerce. Many other plants furnish camphor by oxidation of their essential oil, as lavender, rosemary, marjoram, pennyroyal, peppermint, feverfew, etc. Amber and the oils of valerian, sage and tansy, also yield it when treated with nitric acid.

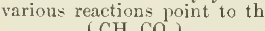
Description.—"White, translucent masses, of a tough consistence and a crystalline structure, readily pulverizable in the presence of a little alcohol, ether, or chloroform; having a penetrating, characteristic odor, and a pungently aromatic taste. Specific gravity: 0.995 at 15° C. (59° F.). Very sparingly soluble in water, but readily soluble in alcohol, ether, chloroform, carbon disulphide, benzin, and in fixed and volatile oils. When camphor is triturated, in about molecular proportions, with menthol, thymol, phenol, or chloral hydrate, liquefaction ensues. It melts at 175° C. (347° F.), boils at 204° C. (399.2° F.), and is inflammable, burning with a luminous, smoky flame. On exposure to the air it evaporates more or less rapidly at ordinary temperatures, and, when moderately heated, it sublimes without leaving a residue. Camphor should be kept in well-closed vessels, in a cool place"—(*U. S. P.*).

Camphor is somewhat unctuous to the touch and, besides being pungent to the taste, it imparts an after-sense of coolness. It is so tough and elastic as to almost defy pulverization, which may be readily accomplished, however, by adding a few drops of alcohol or any of the agents above mentioned. Besides the above-named solvents, acetone dissolves it. It requires about 1300 parts of water for solution; sugar, magnesia, carbonic acid, corrosive sublimate, or spirit of nitrous ether render it more soluble in water. Resins and fats, when heated with it, unite in all proportions. Three isomeric modifications of camphor are known; they can not be distinguished from each other, except by their action upon a ray of polarized light; one of the varieties produces rotation of the ray to the right; the second variety produces left-handed rotation; whilst the third has no sensible effect upon polarized light. The common camphor of commerce, and that obtained by the action of nitric acid upon *bornecne*, is the right-handed modification. The camphor contained in the oil of *Pyrethrum* (*Matricaria*) *Parthenium* exerts a left-handed rotary action upon a ray of polarized light (Chautard); whilst, according to Biot, the camphor deposited by oil of lavender is destitute of any such rotary effect upon a polarized ray. By the application of polarized light, the smallest portion of natural camphor may be distinguished from the artificial camphor (hydrochlorate of camphene). If small fragments of each be placed separately on glass slides, and a drop of alcohol added to each, they dissolve, and speedily recrystallize. If the crystallization of the natural camphor be watched by means of the microscope and polarized light, a most beautiful display of colored crystals is seen, while with the artificial camphor nothing of the kind is witnessed. Camphor is lighter than water, and keeps up a constant rotary motion when small pieces are placed on that fluid.

When camphor is triturated with dragon's blood, guaiacum, galbanum, or asafœtida, the mixture preserves the pilular consistence indefinitely. With benzoin, tolu, mastic, and ammoniac, the mixture becomes soft when exposed to the air. With olibanum, gamboge, euphorbium, amber, and myrrh, the mixture remains pulverulent, though grumous. Asafœtida, galbanum, sagapenum, tolu, dragon's blood, olibanum, mastic, benzoin, tacamahac, guaiacum, and ammoniac, destroy to a greater or less extent the odor of camphor (M. Planche).

Chemical Composition.—The class of substances known as camphors, of which *Japan camphor* ($C_{10}H_{16}O$) is a representative, are products of oxidation of the group of hydrocarbons, known as *terpenes*. These are mostly all isomers of the formula $C_{10}H_{16}$, and, in turn, are hydrogen addition products of the hydrocarbon, *cymol* (*cymene*) ($C_{10}H_{14}$), or para-methyl-iso-propyl-benzene, having the graphic formula $C_6H_4.(CH_3).(C_3H_7)$.

Japan camphor may be converted into *cymol* by distillation with zinc chloride, or with phosphoric anhydride, which agencies abstract from camphor the elements of water, thus: $C_{10}H_{16}O—H_2O=C_{10}H_{14}$. On the other hand, camphor may be obtained (in small amounts) by the oxidation of terpenes. When heated with iodine, ortho-oxycymol (*carvacrol*), an isomer of thymol is formed. These various reactions point to the following graphic formula for Japan camphor:



$$C_3H_7.CH \left\{ \begin{matrix} CH_2.CO \\ CH_2.CH \end{matrix} \right\} C.CH_3.$$

Borneol ($C_{10}H_{18}O$), the camphor obtained from Dryobalanops Camphora, stands to Japan camphor in the simple relation of a secondary alcohol to a ketone. Consequently, borneol, by mild oxidation, yields Japan camphor, and from the latter, inversedly, Borneo camphor may be obtained by reduction with sodium in alcoholic solution. When Japan camphor is heated with nitric acid on a boiling water-bath, *camphoric acid* ($C_{10}H_{16}O_4$) is formed; upon continued oxidation, *cam-*

phoronic acid ($C_9H_{12}O_5$) results. When treated with concentrated sulphuric acid, Japan camphor yields a black solution, from which, upon dilution with water, an oily body, *camphene* ($C_{10}H_{16}$), is precipitated. This substance, which is an isomer of the terpenes, forms, with hydrochloric acid, a crystalline compound, which has the smell of camphor, and is known as *artificial camphor*. It is obtained by passing into oil of turpentine dry hydrochloric acid gas and cooling the compound formed. Artificial camphor melts at 125° C. (257° F.) and boils at 210° C. (410° F.).

The *camphresinic acid* of Schwanert (1863) has been shown to be a mixture of camphoric and camphoronic acids. *Oxycamphor* ($C_{10}H_{16}O_2$) in white, acicular crystals, possessing the characteristic taste and odor of camphor, results from treating camphor with the weaker oxidizing agents (notably hypochlorous acid), and acting upon the bodies thus formed with a solution of caustic potash in alcohol (Wheeler, 1868). With bromine, camphor forms unstable garnet-red crystals, having the composition $C_{10}H_{14}OBr_2$, which yield, on being heated to between 80° and 90° C. (176° to 194° F.), an amber liquid, and evolve hydrobromic acid. On cooling, the liquid congeals, yielding crystals of monobromide of camphor, which may be purified by means of boiling alcohol. Chlorine also unites with camphor, forming monochlorine and dichlorine camphors, while iodine forms with camphor a substitution product.

ACIDUM CAMPHORICUM.—*Camphoric acid* ($C_{10}H_{16}O_4$). Camphoric acid is an oxidation product from boiling camphor and nitric acid, or permanganate of potassium, usually the former. It may be prepared by heating camphor with 10 times its weight of concentrated nitric acid. It presents odorless needle-like crystals, having a faintly acid taste. It is soluble in boiling, but very sparingly soluble in cold water. Fats, essential oils, ether and alcohol also dissolve it. It is a bibasic acid, fuses at 70° C. (158° F.), and may be rendered anhydrous by sublimation. There are 3 isomeric modifications of it, determined by their action upon a ray of polarized light.

Action, Medical Uses, and Dosage.—In large doses camphor is a narcotic and irritant; in small ones, sedative, anodyne, antispasmodic, diaphoretic, and anthelmintic. Very small doses stimulate and large doses depress. Large doses cause œsophageal and gastric pain, vomiting, slow and enfeebled and subsequently intermittent pulse, dizziness, drowsiness, dimness of sight, pallid, cold skin, muscular weakness, cyanosis, spasms, muscular rigidity, and convulsions. Several deaths have resulted from its use, other circumstances contributing somewhat to the fatal issue, but cases of death in a healthy individual have been reported. Mental confusion may follow its excessive use. Its effects in small doses are transient, but are not followed by depression or exhaustion. It exerts an influence on the brain and nervous system, exhilarating and relieving pain, is an excitant to the vascular system, and irritates mucous tissues which are in proximity with it. When given in the solid form, it is capable of producing ulceration of the gastric mucous membrane. It is used to allay nervous excitement, subdue pain, arrest spasm, and sometimes to induce sleep. In the delirium, watchfulness, tremors, and starting of the tendons in *typhoid conditions*, it is of much utility as a nervo-stimulant. *Occipital headache*, from mental overwork, is relieved by small doses, and the external application of camphor. Large doses (grs. xx) are required in *maniacal excitement*. In *inflammatory affections*, as *remittent* and *intermittent fevers*, *acute rheumatism*, etc., it acts beneficially as a diaphoretic and sedative; and is also valuable in *gout*, *neuralgia*, *dysmenorrhœa*, *after-pains*, *puerperal convulsions*, and *painful diseases of the urinary organs*, acting as a sedative, anodyne, and antispasmodic. It is often advantageously combined with opium in *chordee*, and *hysteric nymphomania*, and all *irritations of the sexual organs*. It relieves the *strangury* caused by the use of cantharides. By some physicians it is said to act as an aphrodisiac, exciting the reproductive organs, causing considerable heat in the urethra, and nocturnal emissions; others, again, use it as an antaphrodisiac, and to diminish urino-genital irritation. For the first purpose small doses are effectual; for the second, large sedative doses are requisite. It is said to be an antidote to *poisoning by strychnine*, and has been used in *poisoning from illuminating gas*. An oleaginous injection of camphor in the early stages of *gonorrhœa* often allays urethral irritation, as well as the tenesmus caused by *thread-worms*, *flux*, etc., when injected into the rectum. It enters into many embrocations and liniments for *rheumatic*, *neuralgic*, and *deep-seated pains*, *cynanche tonsillaris*, *contusions* from blows, *sprains*, *chilblains*, *chronic cutaneous diseases*, and as a stimulant for *indolent* and *gangrenous ulcers*. The itching of *smallpox pustules* is said to be relieved by it. It has been found beneficial in *asthma* and *spasmodic cough;* and the powder may be used as a snuff for the relief of *nervous headache*, and *catarrh* in its commencing stages. Camphor is a remedy of marked value in many *bowel troubles*, and is usually used in combination with pain-relieving agents for that purpose. Evidence is strong in its favor as an agent in *Asiatic cholera*. The nervous manifestations of *la grippe* seem to be controlled by small doses of camphor. Spirits of camphor and camphorated oil are well known to allay the pain attending *acute mastitis*, and to check the lacteal secretion. The spirit, on cotton, sometimes allays *toothache*. The best form of using an aqueous solution of this agent is the aqua camphoræ. The administration of opium will best neutralize the evil effects of an overdose of camphor. Small and repeated doses of alcohol may also be given. Dose of the powder, 1 to 10 grains; aqua camphoræ, flʒii to flʒiv; spirits of camphor, 1 to 30 drops.

CAMPHORIC ACID is sedative and antiseptic. It has been lately advocated as an efficient remedy for the *night-sweats of pulmonary consumption*. It is considerably employed in 1 per cent solution in *catarrhal diseases*, both acute and chronic, good results being reported from its use in *sore throat*, *acute nasal catarrh*, *acute bronchitis*, *irritable bladder*, *cystitis* (acute and chronic), *strangury*, *enuresis*, and *nocturnal seminal emissions*. It has made some impression for good in spasmodic states, as *epilepsy*, *hysteria*, and *chorea*. For local use it may, if desired, be combined in solution with borax, or boric acid. The dose is from 10 to 25 grains in solution or in capsules. Solutions of from 1 to 4 per cent are locally employed.

Specific Indications and Uses.—"Insomnia and restlessness, the pulse being soft and tongue moist; diarrhœa" (Scudder). Low grades of inflammation and fevers, particularly typhoid, with great restlessness, morbid watchfulness, muttering delirium, subsultus, dry skin, and quick, irritable pulse (Locke); strangury; urination frequent, difficult, and tenesmic. For specific use $\frac{1}{8}$ to 1 grain doses. In minute doses in burning pain in stomach; dizziness, nausea, and vomiting: weak, husky voice; cyanotic countenance, with cold extremities.

Related Camphors and Camphor Oils.—Many essential or volatile oils, when subjected to distillation, yield a product liquid at ordinary temperatures, which is a hydrocarbon (usually of the terebenthene class or series [$C_{10}H_{16}$]), often termed an *elæopten*, and a portion solid at ordinary temperature, an oxidation product known as a *stearopten*. The latter often exists as a vegetable exudate, or may be derived from vegetation by proper treatment. It has a higher boiling point than the *elæopten*. The stearoptens are known under the general and elastic term *camphors*, and have the general composition $C_{10}H_{16}O$, and, though obtained from many plants, it is altogether probable that they are identical with laurel camphor.

BORNEO CAMPHOR. *Camphol*, *Borneol*, *Malayan camphor*, *Camphyl alcohol*, *Sumatra camphor*, *Barus camphor*, *Dryobalanops camphor*.—Composition $C_{10}H_{18}O$. Found under the bark and in fissures of the trunk of *Dryobalanops Camphora*, Colebrooke (*Dryobalanops aromatica* of Gaertner), of the natural order *Dipterocarpaceæ*. India, Sumatra, and Borneo.

Borneo camphor contains 2 atoms more of hydrogen than common camphor. It is an alcohol yielding ethers with acids. It requires a heat of 198° C. (388° F.) to melt it, is less volatile, but denser and harder than ordinary camphor; it boils at 211.6° C. (413° F.). Its smell, solubility, and general appearance are like those of common camphor, and it exerts a somewhat more feeble right-handed rotary action upon polarized light. On account of its crystallizing in the regular system, however, it is stated by Descloizeaux (1870) and confirmed by Flückiger (1874), that it displays no colors under the polarization microscope. Its taste differs from that of ordinary camphor in being both camphoraceous and hot and peppery. It crystallizes in small, transparent, regular, colorless, 6-sided prisms, and is converted into ordinary camphor when gently heated with nitric acid of moderate strength, which causes a loss of 2 atoms of its hydrogen. It is naturally associated with an oil termed bornéene ($C_{10}H_{16}$), which is isomeric with oil of turpentine and with *valerene*, and which is removed by distillation in order to obtain the camphor free from it. Dryobalanops camphor is a little heavier than water and falls to the bottom, while the laurel variety floats. It does not possess the gyratory movements of the laurel camphor; has generally a tabular form; an amberous odor, and is usually accompanied with foreign substances, among which are amorphous resin, neither acid nor volatile, but which, when heated, gives out an odor of colophony. Borneol may be made artificially by hydrogenating laurel camphor. Borneo camphor is sold at an excessively high price in the East and is never found in our markets.

NGAI CAMPHOR, *Blumea camphor*.—A camphor identical in composition ($C_{10}H_{18}O$) with borneol, but different in turning the ray of polarized light, as much to the left as borneol does to the right; derived from a southeastern Asia composite plant, known to the Chinese as *Ngai*, and to botanists as *Blumea balsamifera*, De Candolle. By oxidation with nitric acid it yields a camphor identical in composition with laurel camphor ($C_{10}H_{16}O$), but still retaining its lævogyre behavior. It is prepared in Canton and the Hainan Isle, and used by the Chinese as a medicine and in perfuming choice Chinese inks. Its price being about tenfold higher than that of common camphor, prevents its occurrence in European and American commerce. Its physical appearance, after sublimation, is identical with that of borneol.

Blumea lacera is used in India as an insecticide. It yielded Dymock, a pale-yellow essential oil of extraordinary left-rotating power. Its density, at 26.6° C. (80° F.), is 0.9144.

Champaca Camphor.—*Champacol* ($C_{17}H_{30}O$). A new camphor from champaca wood. Isolated by Merck (1893).

Formosa Camphor Oil. *Camphor oil of Formosa, Oleum camphoræ* (*U. S. P.*, 1870), *Camphor oil.*—This oil is drained off the crystals of crude camphor in the preparation of the latter, and prepared to some extent when camphor is refined. It is a brownish-colored liquid, holding in solution quite a quantity of camphor, which crystallizes out of the oil when the latter is subjected to a reduced temperature. It has the taste of common camphor and a sassafras-like odor, by which it may be readily distinguished from Borneo camphor oil (*Pharmacographia*). It has a density of 0.940; its boiling point is near 180.5° C. (357° F.). Like laurel camphor it is dextrogyre in behavior. Flückiger (*Pharmacognosie*, 1891) mentions as the constituents of this oil the following: *Dipentene* (cinene) ($C_{10}H_{16}$), a hydrocarbon boiling at 182° C. (359.6° F.), capable of yielding addition products with bromine ($C_{10}H_{16}Br_4$), fusing point 126° C. (245.2° F.); also with hydrochloric acid ($C_{10}H_{16}[HCl]_2$), and with water ($C_{10}H_{16}[H_2O]_3$). Besides, Schimmel & Co. (*Report*, Oct., 1888) made known the following constituents: Pinene, phellandrene (both $C_{10}H_{16}$), cineol ($C_{10}H_{18}O$), safrol, eugenol, and a considerable amount of a hydrocarbon, identical with that obtainable from cubebs.

Borneo Camphor Oil. *Camphor oil of Borneo, Sumatran camphor oil, Bornéene.*—An oil derived from the tapped or felled trees (*Dryobalanops Camphora*, Colebrooke) which yield Borneo camphor. It has been said to be secreted in such great quantities in old trees, and to exert such great pressure as to disrupt the trunk of the tree, the bursting causing a report like that from a cannon. A similar phenomenon is said to take place in the tree furnishing copaiva balsam (*Pharmacographia*). Bornéene ($C_{10}H_{16}$) is isomeric with pure turpentine, and is a volatile, viscid, brownish-red oil, composed of borneol and resin dissolved in bornéene, a liquid having a turpentine-like odor, and identical with the *valerene* of valerian oil. It does not deposit Borneo camphor on standing even when subjected to a very low temperature. In its optical properties it is dextrogyre.

Camphor Preparations.—Vinum Camphoratum. *Wine of camphor.*—This is a turbid, whitish fluid, prepared according to the *German Pharmacopœia*, by dissolving 1 part of camphor in 1 part of alcohol and incorporating gradually, and with agitation, 3 parts of mucilage of acacia and 45 parts of white wine. Its use is the same as that of spirits of camphor, and it must be shaken before dispensing and administering.

Camphora Carbolisata. *Camphora phenolata, Carbolated camphor, Phenol camphor, Camphorated phenol.*—An oily or colorless liquid, having a camphoraceous odor, practically insoluble in glycerin and water, but soluble in alcohol, fixed oils and ether. Hager prepares it by dissolving 100 parts of camphor and 36 parts of carbolic acid in 4 parts of alcohol: Bufalini, by allowing 2 parts of camphor and 1 part of phenol to liquefy. A local anæsthetic and antiseptic. Ten-drop doses of an olive-oil solution have been given in *catarrh of the stomach*, and the same applied has arrested *erysipelas*. *Wounds, ulcers, boils*, and *herpetic skin affections*, as well as *diphtheric membranes*, have been painted with it, and *uterine leucorrhœa* locally treated with it, with asserted relief. It is said to relieve the pain of *ingrown nails* and *dental caries*.

Camphora Salicylata. *Salicylated camphor.*—Heat, by means of a water-bath, to 90° C. (194° F.), a mixture of 65 parts of salicylic acid and 84 parts of camphor until liquefaction takes place (Guirleo). An oily fluid, devoid of color, and becoming a solid opaque mass which, when triturated, assumes an unctuous consistence. Fixed and volatile oils dissolve it, while it is much less soluble in water or glycerin. Useful, locally, in *syphilitic phagedena* and *ulcerations*. Suppositories are sometimes made of it by combining it with 10 to 15 parts of petrolatum, with a little paraffin added to give hardness.

CAMPHORA MONOBROMATA (U. S P.)—MONOBROMATED CAMPHOR.

Formula: $C_{10}H_{15}BrO$. Molecular Weight: 230.42.

Synonym: *Bromated camphor.*

Formation and History.—Camphor unites directly with bromine in the cold without evolution of gas, forming bibromide of camphor ($C_{10}H_{16}OBr_2$), which was discovered by Laurent in 1840. This compound is unstable, being decomposed even by the atmosphere. In 1861, Th. Swartz found, that when bibromide of camphor is heated in sealed tubes, decomposition ensues, whereby hydrobromic acid is split off and a monobromated camphor compound remains, thus, $C_{10}H_{16}OBr_2 = C_{10}H_{15}OBr + HBr$. It was also shown that camphor and bromine heated together for 3 hours in sealed tubes, would accomplish the same result, and doubtless in this instance also bibromide of camphor is first formed. In 1865, W. H. Perkin, independent of former investigators, prepared monobromated camphor while experimenting upon Laurent's bibromide of camphor, and named it bromo-camphor (*Jour. Chem. Soc.*, 1865).

Monobromated camphor was first experimented with, as a therapeutic agent, by Prof. Deneffe, of Ghent. In 1872, an article in its favor appeared in the *N. Y. Med. Jour.*, May, p. 522, from W. A. Hammond, M. D., and from this time numerous articles in the various medical journals created a demand for it.

Preparation.—The fact that sealed tubes were unnecessary for the practical preparation of the article was shown by Prof. Maisch, in the *Amer. Jour. Pharm.*, August, 1872. The writer recommends the following process, which varies somewhat, in certain respects, from that by Prof. Maisch, as one which he has employed quite extensively in his laboratory work: Take of camphor, in small pieces, 15 troy ounces; cold bromine, 16 troy ounces. Place the camphor in a tubulated retort, of not less than ½-gallon capacity, and connect the exit by means of a rubber tube, with a glass tube extending into ammonia water; then, through a funnel, pour upon the camphor 4 troy ounces of bromine. As soon as the temperature begins to rise, stop the tubulure of the retort, and occasionally agitate the contents. The mixture will partially liquefy, and the temperature will increase spontaneously, with evolution of gas, until about 71.1° C. (160° F.), is reached; from which point the heat must be continued by means of a steam or water-bath to 93.3° C. (200° F.). The flow of gas will now cease, and the stopper of the retort must be immediately removed, in order to prevent the ammonia being drawn into the retort by absorption of hydrobromic acid and the contraction of the cooling gas. When the contents of the retort have become cool, cautiously pour into it 4 troy ounces of the bromine, care being taken that the contraction caused by the bromine vapor coming into contact with the gas within the retort, followed by subsequent expansion, does not throw a part of the bromine upon the operator. Now repeat the preceding operation, and when the reaction ceases, cool as before. In like manner, add the remainder of the bromine in successive portions of 4 troy ounces, raising the temperature, as in the previous instances, to 93.3° C. (200° F.), after each addition. Lastly remove the stopper, and permit the contents to cool to about 10° C. (50° F.), and remain for 24 hours, when there will be a mass of crystals formed. Invert the retort, and permit the thick liquid to drain from the crystals; then pour upon them 16 fluid ounces of alcohol, and dissolve by means of a gentle heat and agitation; then decant the solution into an evaporating basin, and cool gradually, when crystals of monobromated camphor will separate; these should be purified by dissolving again and recrystallizing from their solution in 16 fluid ounces of hot alcohol. The yield will about equal the weight of the camphor employed. By-products are generated also by other reactions, so that the theoretical amount of monobromated camphor is never obtained. If the temperature of the bibromide be retained at about 10° C. (50° F.), by means of ice, no decomposition of bibromide follows. After the addition, each of the first and second portions of 4 ounces of bromine, in the foregoing process, decomposition of the bibromide ensues when the temperature reaches 68.3° C. (155° F.). It is not advisable to permit the temperature, at any time during the reaction, to exceed 93.3° C. (200° F.), as the reduction of the bibromide will have occurred at this point, and when too great heat is employed volatilization of the contents of the retort ensues, and to some extent, destructive decomposition, with formation of a black oil (perhaps containing finely divided carbon), difficult to remove from the crystals. The hydrobromic acid forms bromide of ammonium with the ammonia water, and this salt may be obtained by evaporating the solution of ammonia after the reaction.

Description.—"Colorless, prismatic needles or scales, having a mild, camphoraceous odor and taste, permanent in the air, unaffected by light, and neutral to litmus paper. Almost insoluble in water, freely soluble in alcohol, ether, chloroform, hot benzin, and fixed and volatile oils; slightly soluble in glycerin. It is also soluble, without decomposition, in cold, concentrated sulphuric acid, from which it separates again unaltered, when the solution is poured into water. It melts at 76° C. (168.8° F.), and sublimes at a slightly higher temperature. At 274° C. (525.2° F.), it boils without decomposition, and is finally volatilized without leaving a residue"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Monobromated camphor was first introduced to the profession, as a sedative to the nervous system, by Prof. Deneffe. M. Bourneville, who experimented with it upon different animals, as cats, rabbits, guinea pigs, and frogs, concluded, from the results obtained, that this article diminished the number of pulsations and determined a contraction of the auricular vessels; that it diminished the number of inspirations, reduced the temperature in a regular manner, and that it possessed undeniable hypnotic properties, appearing to act principally upon the cerebral system. Its continued use, at least with cats and guinea pigs, determines a rapid emaciation. The diseases in which it has been extolled as a remedy, are certain forms of *mental alienation* with excitation, *chorea*, *paralysis agitans*, *fevers*, and *acute diseases*, *hysteria*, *delirium tremens* (when wild, and the temperature is increased), *convulsions of children*, especially when due to *dentition*, *insomnia*, *satyriasis*, *nymphomania*, *spasm of the glottis*, *nervous palpitation of the heart*, *pertussis*, *headache*, and *dyspnœa* of *asthmatic* or *cardiac origin*. In fully developed *mania* it is less useful than chloral, but may be employed where the mania is less pronounced and there is slight nervous derangement, with increase of temperature. Give 2 or 3 grains every 2 or 3 hours. In the *convulsive disorders of children* it is less valuable than chloroform to check the spasms when severe, but may be used in mild cases. One grain in mucilage may be given every hour to a child, and 15 or 20 grains are admissible in a day. According to Prof. Locke, it is a better agent to prevent the return of convulsions than to arrest them. It is likewise stated to have proved beneficial in *spermatorrhœa* with great nervous excitability. M. Lannelongue prescribed it with benefit in painful *cystitis*, when the pain is not the result of any organic lesion—*neuralgic cystitis*. Also in *cystitis* of the neck of the bladder, of congestive origin and associated with a vascular lesion of the neck, the result of various causes; if *vesical catarrh* be combined with the cystitis, the effect will be nearly null. If the vesical catarrh be slight, even when a more or less *acute prostatitis* is associated with the inflammation of the vesical neck, the effects will be well marked.

While many experimenters have highly praised this agent as a successful remedy in the affections above referred to, many others have repudiated it as being much less efficient than the alkaline bromides. This discordance of opinions, together with its disagreeable taste, has, in a measure, prevented its coming into more general use. The dose of monobromated camphor is from 3 to 30 grains per day, in form of pills, dragees, or elixir. An elixir has been proposed as follows: Take of alcohol (90 per cent), 4 fluid ounces; glycerin, 3 fluid ounces and 3 fluid drachms; water, 2½ fluid ounces; mix together, and then add monobromated camphor, 46 grains. Gently heat the mixture until the camphor is dissolved.

Specific Indications and Uses.—Simple insomnia, headache; mental excitement; delirium; hysteria: mild infantile convulsions.

CANELLA.—CANELLA BARK.

The bark of *Canella alba*, Murray (*Canella Winterana*, Gaertner; *Winterania Canella*, Linné).

Nat. Ord.—Canellaceæ.

COMMON NAMES: *White wood tree*, *Wild cinnamon tree.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 26.

Botanical Source.—Canella alba is a straight tree, from 20 to 50 feet high, with erect branches at the summit only. The bark is yellowish-white; the inner bark thick, smooth, and pale, with a biting, aromatic taste. The leaves are scattered, shining, and yellowish-green, obovate, cuneate at the base, dotted when young, opaque when old, and petioled. The flowers are terminal, small, and borne in clusters, and of a purple color; the petals are concave, erect, thick, and deciduous. Berry the size of a pea, fleshy, smooth, blue, or black, hot and biting while green; seeds generally 2. Stamens combined in a tube; anthers 15, resembling furrows; stigmas 3 (L).

History.—This is a South American tree, being indigenous also in sections of south Florida, and in many of the isles of the West Indies. The bark was introduced into Europe early in the seventeenth century. The corky layer of the bark, which is of a silver-like color, is removed by beating and cutting, after which the commercial bark is obtained. The drug is exported only from the Bahama isles.

Description.—The bark is of a pale yellowish-white color (externally slightly yellowish-red with elongated scars disposed transversely), occurring in quills or hard, twisted pieces, with an acrid, peppery taste, an aromatic, clove-like, or cinnamon-like odor, and a short, white, granular fracture. On breaking the bark, numerous resin cells, appearing as orange-yellow specks, are scattered throughout the whiteness of the internal structure. Alcohol extracts its properties, the tincture being of a yellow color, and becoming white when water is added. It pulverizes readily, yielding a powder of a pale-yellow color.

Chemical Composition.—When the bark is distilled with water an essential oil may be had, of a dark-yellowish color, having a powerful aroma and intense acridity; a pound of the bark yields about a drachm of oil. Besides, analysis has discovered in it gum, starch, bitter extractive, resin, albumen, and various saline substances. Analyses were made by Henry (1821), and Petroz and Robinet (1822), the latter observers finding a body to which they gave the name *canellin*, subsequently (1843) shown, by Meyer and Von Reiche, to be identical with mannit, which exists to the extent of about 8 per cent. The last-named chemists showed the presence of *eugenol* in the volatile oil, and also demonstrated the presence of another oil bearing a close resemblance to the principal constituent of oil of cajeput. Two other oils were found, but have not been thoroughly studied. The ash was found to be largely calcium carbonate. No tannin is present in the bark.

Action, Medical Uses, and Dosage.—Canella bark is an aromatic stimulant and tonic, useful in *enfeebled conditions of the stomach and alimentary canal.* It is generally used in conjunction with other tonics. It is employed in the West Indies as a spice, and has been advised in *scurvy*, and *in chlorotic, post partum*, and *carcinomatous menorrhagia.* Some smokers add this bark to their smoking tobacco to remove the unpleasant odor from the tobacco, and to impart a degree of fragrance to their smoking-rooms. Dose, 10 to 40 grains.

Related Species.—*Cinnamodendron corticosum*, Miers; Jamaica. Used by the natives for the same purpose as the canella bark, for which it is frequently sold. Cinnamodendron bark contains tannin; hence its decoction yields a black coloration with ferric salts, thereby differing from canella bark, which it is thought to resemble in other respects chemically. The bark is grayish-brown or ferruginous in color, the corky warts leaving a nearly circular scar, instead of the elongated, transverse scar of the true bark.

Cinnamodendron macranthum, Baillon; Porto Rico. Yields a bark resembling the preceding, and is substituted for canella bark.

The barks of the above species and canella bark itself have been sold as Winter's bark (see *Wintera*).

CANNABIS INDICA (U. S. P.)—INDIAN CANNABIS.

"The flowering tops of the female plant of *Cannabis sativa*, Linné: grown in the East Indies"—(*U. S. P.*).

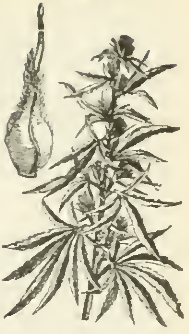
Nat. Ord.—Urticaceæ.

COMMON NAME: *Indian hemp.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 231.

Botanical Source.—Cannabis sativa is a herbaceous annual, growing from 4 to 9 feet high, covered with a very fine, rough pubescence, scarcely visible to the naked eye. The stem is erect, branched, bright-green, and angular. The leaves are alternate or opposite, on long, lax petioles, digitate and scabrous, with linear-lanceolate, sharply serrated leaflets, tapering into a long, smooth, entire point; the stipules subulate. The flowers are borne in axillary clusters, with subulate bracts; the males are lax and drooping, and branched and leafless at the base; the females are erect, simple, and leafy at the base. The calyx of the male is downy; of the female, covered with short, brownish glands. The fruit is an ovate, 1-seeded achenium; the seeds are roundish-ovate, slightly flattened, 1 or 2 lines long, without odor, of a sweetish, oleaginous, unpleasant taste, and glossy, and grayish in color (L).

Fig. 54.



Cannabis sativa.

History.—Hemp (*Cannabis indica* of Lamarck), is indigenous to Persia and northern India, and is cultivated in many other countries. It is naturalized in North America, Brazil, and Europe. The hemp of this country (the preparations of which are often referred to as *Cannabis sativa* in contradistinction to *Cannabis indica*, an error which should not be continued), is identical with the Eastern plant in its botanical characters, but differs somewhat from it in its physical qualities, the India plant being more powerful in its effects on the system, and which is probably owing to the influence of climate, cultivation, etc., or perhaps, from the absence of some ethereal ingredient. In the Eastern countries an infusion of hemp, prepared with cold water, is much employed as an intoxicating drink.

Several native names are applied to different parts or products of this plant. Thus the leaves and smaller stalks, dried and broken coarsely, and intermixed with a few capsules, is known as *bhang* (Hindustan), *siddhi* (Bengal), *sabzi* (Bombay), and *hashish* (Arabia). Our modern term *assassin* is said to have arisen from this word, the name *Hashshashin* (assassin), having been applied to a murderous Persian sect, which, in its religious rites, used hemp (hashish) to intoxication. *Bhang* is almost tasteless, and is of a dark-green color. It is smoked with tobacco, or without the latter, but usually is incorporated into a sweetmeat known as *majun*. The flowering and fruiting tops, from which the resin has not been removed, are known as *ganja*, *ganjah*, or *gunjah* in India, and as *guaza* in London and other drug markets. These occur as compressed, brittle, brown-green shoots, or as stiff, ligneous stems with flowering and fruiting shoots attached, both varieties having a glutinous aspect. Like bhang, it is without a pronounced taste.

The concrete resinous exudation of the plant is known in India by the name of *churrus* or *charas*. This is peculiar in being the production of those plants, scarcely more than 3 feet high, growing in elevated situations (6,000 to 8,000 feet, Jameson). The natives, clothed in leather apparel, run among the hemp plants, beating them, and thus gather the resin which adheres to their garments, from which it is afterwards removed by scraping. Or it may be obtained by rubbing the ripened fruit-tops between the hands, from which it is afterward scraped and formed into balls. This kind is most valued, and is known as *momeea* (waxen churrus). A third and more dangerous method is that of stirring dried bhang and collecting the dusty, resinous powder shaken therefrom. Hemp has long been raised for its textile fibers and for its oily seeds. The fibers are largely used in making cordage, and the seeds for feeding birds, and for the expression of oil of hempseed, mostly prepared in Russia, which is used in mixing paints, and manufacturing varnish and soap, and has been used as an illuminating oil, though not well suited for this purpose. The Poles and Russians, it is said, eat the roasted seeds with bread as a condiment (*Amer. Ency.*, Hemp).

Description.—CANNABIS INDICA. "Branching, compressed, brittle, about 5 Cm. (2 inches) or more long, with a few digitate leaves, having linear-lanceolate leaflets, and numerous sheathing, pointed bracts, each containing 2 small, pistillate flowers, sometimes with the nearly ripe fruit, the whole more or less agglutinated with a resinous exudation. It has a brownish-green color, a peculiar, narcotic odor, and a slightly acrid taste"—(*U. S. P.*).

FRUCTUS CANNABIS, *Hempseed.*—Hempseed is about $\frac{1}{8}$ to $\frac{1}{6}$ of an inch in length, subglobular, somewhat compressed, and possessing a marginal keel, whitish in color. The testa is brownish or olive-gray, smooth, shining, brittle, and marked with veins. The inclosed greenish seed is oily, with a sweetish, oleaginous taste, and but a faint odor.

Chemical Composition.—The leaves of cannabis contain chlorophyll, coloring matter, extractive, a volatile oil, a green, resinous body, gummy extractive, a bitter body, albumen, lignin, sugar, and salts, as potassium nitrate, silica, phosphates, and other salts. The chemistry of the active constituents is not yet well determined. Not since T. & H. Smith (1846), declared that the soporific, calmative, and other properties, resided in the resin *cannabin*, have any very material advances been made. Personne (1857) thought the activity of the drug depended upon its volatile oil, the vapor of which is stupefying. He succeeded in separating it into two parts—*cannabene* ($C_{18}H_{20}$), a fluid, and *cannabene hydride* ($C_{18}H_{22}$), a crystallizable solid. The oil rectified (over sodium), is miscible with alcohol, boils at 256° to 258° C. (492.8° to 496.4° F.), and has a density at 0° C. (32° F.), of 0.9292. Bromine energetically attacks it (Valente, 1881).

The *cannabin* of T. & H. Smith is the alcoholic or resinous extract employed in medicine; it is prepared from the dried flowers and incipient fruit, with the smaller branches of the plant (*gunjah*). This extract is prepared according to the directions of Messrs. Smith, as follows: "Digest bruised gunjah in successive quantities of warm water till the expressed water comes away colorless; and again for two days, at a moderate heat in a solution of carbonate of sodium, in the proportion of 1 part of the salt to 2 of gunjah. Coloring matter, chlorophyll, and inert concrete oil being thus removed, express and wash the residuum, dry it, and exhaust it by percolation with rectified spirit. Agitate with the tincture, milk of lime containing an ounce of lime for every pound of gunjah, and after filtration, throw down the excess of lime by a little sulphuric acid. Agitate with the filtered liquor a little animal charcoal, which is afterward to be removed by filtration. Distill off most of the spirit, add to the residual tincture twice its weight of water in a porcelain basin, and let the remaining spirit evaporate gradually. Lastly, wash the resin with fresh water till it comes away neither acid nor bitter, and dry the resin in thin layers." This resinous extract contains the taste and odor of gunjah, and its activity is not impaired when exposed in air for 8 hours to a temperature of 82.2° C. (180° F.). One hundred pounds of dry gunjah yield about 6 or 7 pounds of this extract (P). It has a dark, dull-green color, a peculiar narcotic, somewhat fragrant odor, and a hot, somewhat bitter, and acrid taste. It is mostly soluble in alcohol, chloroform, ether, oil of turpentine, olive oil, and partially in benzol; its terebinthine solution deposits minute scaly crystals on standing. It burns without leaving a residue. When water is added to its solution in alcohol, a white precipitate falls. It may be distinguished from the extract of common hemp by the following tests: Resinous extract of Indian hemp only partially dissolves in liquor potassæ, while that of common hemp dissolves readily; nitric acid, sp. gr. 1.38, converts the former, with red fumes and rapid reaction, into an orange-red resinoid substance, amounting to nearly the same quantity as the resin under treatment, while the extract of common hemp gives but a small amount of resinoid (Prof. W. Procter).

In the year 1876, Preobraschensky obtained a volatile alkaloid which he believed to be nicotine, but Dragendorff suggests the possible admixture of tobacco, as the latter and hemp are frequently smoked together; at least others have not succeeded in isolating nicotine from hemp. By using the methods for extracting nicotine, Siebold and Bradbury (1881), extracted a very minute quantity of *cannabinine*, a varnish-like mass. In 1883, Matthew Hay arrived at the conclusion that several alkaloids are contained in the plant—one of which, in crystalline form and possessing tetanic properties, he succeeded in isolating in minute quantity and named *tetano-cannabine*. Jahns (1889), however, claims this body to be identical with choline. In 1891, H. T. Smith extracted a varnish-like alkaloid, possessing the odor of coniine; of this he formed a sulphate which crystallized from alcohol. More recently (1895), F. Marino-Zuco, and G. Vignolo (*Gazetta Chimica Italiana*, 1895, part I, pp. 262-8), have attempted to determine definitely the constituents of the drug. They succeeded in obtaining from the drug by means of water acidulated with sulphuric acid, an alkaloidal base, the hydrochloride of which formed a deliquescent, crystalline mass, which to the heart is a powerful depressant. As vegetable acids destroy or render practically inert the action of Cannabis indica (Polli), it is not readily accepted that a stronger acid should be expected to extract the active principle or principles (*Pharm. Jour.*, 1895). The *Pharmaceutical Journal*, 1895, remarks: "The chemistry of this remarkable and powerful drug still remains to be elucidated, therefore, and the active principles to which its complex action is due yet await isolation. It may, perhaps, serve as a hint to investigators, to recall a statement which appears in Schlimmer's (Persian) *Pharmacopœia* (p. 102), from which it appears that the dervishes make an extremely somniferous preparation by boiling the tops of Indian hemp in fresh butter or oil of almonds. 'Of this a sufficiently minute quantity introduced into an ordinary culinary preparation will cause an entire family to sleep for 24 or 72 hours, without the taste of cannabis being detected.' Assuming the intoxicant action and the odor of Indian hemp to be due to a volatile constituent likely to be driven off by the boiling process, the use of the oil as a solvent might serve to separate the most important active principle, and another might be separated by distillation. Hitherto most of the processes adopted appear to have yielded products incapable of causing the characteristic action of the drug." Gastinel's *hashiscin* is an alcoholic extract of gunjah, from which the water-soluble principles are excluded. Bombelan's *pure cannabin*, Merck's *cannabin tannate*, or Kobert's *cannabindine*, are not thought to be the active principle proper (*Pharm. Jour.*, 1895).

Action, Medical Uses, and Dosage.—Administered to healthy persons in large doses, cannabis creates more or less disturbance in the digestive tract, affects the nervous system with convulsive movements and sudden shocks, causes congestion of the brain, confused ideas, exalted imagination with frequently changing pictures, torpor, and sleep; the cerebral symptoms being more constant, while the others vary to a great extent, sometimes nothing occurring but a few confused ideas followed by sleep. The long-continued use of this article induces injected eyes and bloating of the face, prostration, dropsy, sudden attacks of dangerous mania, and occasionally catalepsy and imbecility, followed by a marasmic state, ending in death. Death has not been known to result directly from the effects of cannabis, except when continually used until marasmus is induced, when death may occur from the latter condition. The symptoms of acute poisoning vary greatly, probably owing to the uncertain character of the drug employed. Collapse, unconsciousness, stupor, catalepsy, extreme debility, irresponsive pupils, cold, clammy skin, spasms and convulsions are among its toxic effects. A marked feature is the anæsthesia produced, and it is asserted that the Chinese formerly performed surgical operations under its use. The effects from large doses are best combatted by vegetable acids, especially lemon juice, coffee, emetics, cold applications and leeches to the temples. Probably strychnine and faradization of the respiratory muscles are the most effective means. By some coffee is said to increase its effects. Indian hemp is considered anodyne, hypnotic, antispasmodic, and phrenic, producing sleep even where morphine has failed, and without impairing the appetite, repressing the secretions, or causing constipation like opium and its preparations. It frequently allays *pain*, and has been found of great benefit in *hysteria*, *chorea*, and other *nervous affections*. Its effects upon the system vary under different conditions, thus: It lessens pain, checks spasmodic action, improves the appetite, causes sleep, exhilaration of spirits, and, in increased doses, inebriation, with phantasms, catalepsy, illusory delirium, and strong aphrodisia. Its continued use, however, lessens the venereal appetite and power. It occasions dilatation of the pupils and prevents normal perception more strongly than any other agent. A peculiarity observed in those who take cannabis is the strong and voracious appetite induced. Medicinally, in small doses, its effects are less intense than those of opium, and the excretions are not so much suppressed by it; it does not disturb digestion, rather increases the appetite, seldom induces sickness of the stomach, never causes congestion, and disturbs the expectoration far less than opium, also effects the nervous system much less, and produces a more natural sleep without interfering with the actions of the internal organs. Cannabis is one of the most important of our remedies, but, like our best agents, it must not be used indiscriminately, but its cases should be specifically selected. The great indication for cannabis (the keynote) is *marked nervous depression*. With this indication present it will fulfil a multitude of uses. Specifically selected it has been efficient in *delirium tremens*, *wakefulness in fevers*, *neuralgia*, *gout*, *rheumatism*, *infantile convulsions*, *low mental conditions*, *insanity*, etc., and in *inflammatory conditions* in cases where opium disagrees, and is often preferable to opium. *Acute mania* and *dementia*, *epilepsy*, *hysterical catalepsy*, *cerebral softening* (with potassium bromide), *anemia of the cerebral cortex*, *paralysis agitans* and *senile tremors*, *traumatic* or *idiopathic tetanus*, and *irritable reflexes*, are among the nervous disorders in which it exerts a positively beneficial and soothing action, when depression is the guide to its selection. In mental disturbances the guides to its use are mental oppression, a dull, drowsy, or stupid countenance (a dreamy condition), with dizziness and violent throbbings in the head, and a morbid fear of becoming insane. The patient sometimes has an "exaggerated idea of time and space" (Webster). The drug is a useful hypnotic for the *insane*. As a remedy for *pain*, it ranks among the first; the more spasmodic the pain the better it acts. The neuralgic pains of depression are those most quickly relieved. It should be administered in painful states of the stomach, as *gastric neuralgia*, *nervous gastralgia*, in *gastric ulcers*, where opium is inadmissible, and in pain due to indigestion. The pains attending *lientery*, *after-pains*, the passage of *renal* and *hepatic calculi*, *gout*, *neuralgia of the uterus*, *cancer*, *locomotor ataxia*, are all met by it, and, added to purgatives, it mitigates their griping effects. It relieves the itching of *cutaneous disorders*, particularly that of *senile pruritus* and *eczematous affections*. *Migraine*, *nervous headache*, *facial*, and other *neuralgias*, whether due to catamenial wrongs or attending the menopause, as well as those depending upon fatigue, are releived when nervous depression is the most marked symptom. *Head-pains*, due to *tumors*, have been asserted to yield to cannabis. The pains of *chronic rheumatism*, *sciatica*, *spinal meningitis*, *dysmenorrhœa*, *endometritis*, *subinvolution*, and the vague pains of *amenorrhœa*, with depression, call for cannabis. Owing to a special action upon the reproductive apparatus, it is accredited with averting *threatened abortion*. It is a prominent remedy for certain spasmodic conditions and especially in the *choreic states* of weak women and children. It mitigates *whooping-cough* and other *convulsive coughs;* alleviates *palpitation of the heart*, with stitching pain in the part; quiets *hysterical manifestations*, and allays the distressing symptoms of *spasmodic asthma*, and *periodic hyperæsthetic rhinitis*. It is a valuable remedy in *senile catarrh*, with harrassing cough and profuse mucous expectoration, and, both internally and by inhalation, it has afforded relief in the painful *cough of consumptives*.

Cannabis is said in many cases to increase the strength of the uterine contractions during parturition, in atonic conditions, without the unpleasant consequences of ergot, and for which purpose it should be used in the form of tincture (see below), 30 drops, or specific cannabis, 10 drops, in sweetened water or mucilage, as often as required. In *menorrhagia*, the tincture in doses of 5 or 10 drops, 3 or 4 times a day, has checked the discharge in 24 or 48 hours.

The greatest reputation of cannabis has been acquired from its prompt results in certain disorders of the genito-urinary tract. In fact, its second great keynote or indication is *irritation of the genito-urinary tract*, and the indication is even of more value when associated with general nervous depression.

It is, therefore, useful in *gonorrhœa*, *chronic irritation of the bladder*, in *chronic cystitis*, with painful micturition, and in *painful urinary affections* generally. It makes no difference whether a *urethritis* be specific or not, or whether it is acute or chronic, the irritation is a sufficient guide to the selection of cannabis. Use it in *gonorrhœa* to relieve the ardor urinæ, and to prevent urethral spasm and avert chordee, and in *gleet*, to relieve the irritation and discharge; employ it also in *spasm of the vesical sphincter*, in *dysuria* and in *strangury*, when spasmodic. Burning and scalding in passing urine, with frequent desire to micturate, are always relieved by cannabis. The following is said to be a certain cure for *gonorrhœa*: Take, while in blossom, equal parts of the tops of the male and female hemp (*Cannabis sativa*), bruise them in a mortar, and express the juice; to this add an equal portion of alcohol. Dose, from 1 to 3 drops every 2 or 3 hours. It should be remembered that the American hemp has the same properties as the Indian hemp, but is a much feebler product—the difference, therefore, not being, as some have indicated, in action, but merely in degree. Cannabis has been recommended in *diabetes* and *hematuria*, and in *Bright's disease*, with painful voiding of bloody urine, it is strongly endorsed. By its control over the mental functions, it controls lascivious thoughts, dreams and desires, and is, therefore, of some value in *nocturnal seminal emissions*. Probably its control over urethral irritation contributes to its value here. In this manner *impotence* is said to have been cured by it. Cannabis has some reputation as a remedy for *chronic alcoholism*, and for the cure of the *opium habit*.

Externally, the resin may be applied endermically or in embrocation with oils, ointments, chloroform, etc., in *inflammatory* and *neuralgic affections*. It may also be used in injections. The green plant collected in the spring, and 2 or 3 twigs placed in or between beds, will, it is asserted, certainly and effectually cause bedbugs to remove from the room in which they are used. Hemp seed, in infusion, has been found very useful in *after-pains*, and in the bearing-down sensation accompanying *prolapsus uteri*. A combination of cannabis, collodion, and salicylic acid has been used to destroy corns, the extract of the hemp acting as an anodyne.

A tincture may be made by dissolving 24 grains of the resinous extract in a fluid ounce of rectified spirit; for ordinary purposes, its dose is from 10 to 30 drops. The extract varies in strength, which will require a variation in the doses. When well prepared, the dose is from ½ grain to 1 grain; but this may vary from 1 grain to 20 grains, depending entirely on the quality of the article. The English extract is a good preparation, and of all extracts, the smaller dose should first be employed. The tannate of cannabine, in doses of 5 to 15 grains, is said to be an efficient hypnotic, though many declare it inefficient for this purpose. The best preparation is the specific cannabis, which may be given in doses of a fraction of a drop to 10 drops. The ordinary prescription for its specific effects is: ℞ Specific cannabis, gtt. v to xxx; aqua, fl℥iv. Mix. Dose, a teaspoonful every ½ to 2 or 3 hours.

Specific Indications and Uses.—Great nervous depression; irritation of the genito-urinary tract; painful micturition, with tenesmus; ardor urinæ, scalding, burning, frequent micturition; low mental conditions; wakefulness; insomnia, with unpleasant dreams during momentary sleep; spasmodic and painful conditions, with nervous depression; mental illusions; menstrual headache; palpitation of the heart, with sharp stitching pains in the heart; hallucinations; cerebral anemia, from spasm of cerebral vessels.

CANTHARIS (U. S. P.)—CANTHARIDES.

"*Cantharis vesicatoria*, DeGeer"—(*U. S. P.*). (*Lytta vesicatoria*, Fabricius; *Meloë vesicatorius*, Linné).

Class: Insecta. *Order:* Coleoptera.

Common Name and Synonym: *Spanish flies; Muscæ Hispanicæ.*

Source, History, and Description.—There are a number of insects inhabiting various sections of the world which possess acrid properties, and which, when applied to the skin, produce vesication; the most common in use are those under present consideration, Spanish flies, or cantharides, the *Cantharis vesicatoria* of Latrielle, *Meloë vesicatorius* of Linnæus, or *Lytta vesicatoria* and *Cantharis officinalis* of other naturalists. At what period they were introduced into the practice of medicine is a matter of uncertainty. The beetle, called Spanish fly, is a native of Europe, where it is collected principally in south Russia and Hungary; also in Italy and Spain. It is imported into this country from Messina and St. Petersburg. Those from Russia are the best, and may be known by being larger than the French or English varieties and more copper-colored.

General Characters.—Antennæ elongate, simple, filiform; maxillary palpi with terminal joint somewhat ovate; head large, heart-shaped; thorax small, rather quadrate, narrower than the elytra, which are as long as the abdomen, soft, linear, the apex slightly gaping; wings 2, ample (J. F. Stephens). *Cantharis vesicatoria*, De Geer, the Spanish fly, is of an elongated, almost cylindrical form, from 6 to 11 lines in length, and 1 or 2 lines in breadth. This insect may be distinguished from other analogous ones, by presenting 2 shining-green wing covers, which cover 2 membranous wings, ample, thin, veined, transparent, pale-brown; black, jointed antennæ, and a longitudinal furrow along the head and chest. Their smell is strong, virose, very disagreeable, and compared to that of mice; their taste is acrid, burning, and urinous (Ed.). It is of a grass or copper-green color, with numerous whitish-gray hairs on its body and thorax. The head is large, subcordate, the eyes lateral and dark-brown; the thorax not larger than the head and narrowed at the base; the elytra or wing-covers are from 4 to 6 lines long, and from ¾ to 1½ line broad; the costa are slightly margined; the wings 2, with tips folded; the legs are stout, from 4 to 6 lines long, the hinder ones longest. The abdomen is soft, and broadest in the female. In the female, near the anus, are

2 articulated caudal appendages (P.). The *U. S. P.* thus describes cantharis: "About 25 Mm. (1 inch) long and 6 Mm. (¼ inch) broad; flattish-cylindrical, with filiform antennæ, black in the upper part, and with long wing cases and ample, membranous, transparent, brownish wings; elsewhere of a shining, coppery-green color. The powder is grayish-brown, and contains green, shining particles. Odor strong and disagreeable; taste slight, afterwards acrid. Cantharides should be thoroughly dried at a temperature not exceeding 40° C. (104° F.), and kept in well-closed vessels."

The Spanish fly inhabits the earth in the form of a larva, and comes forth in the state of a fly in the month of May. It infests various trees, as the elder, rose, plum, willow, poplar, and elm, but more especially the privet, lilac, ash, and honeysuckle. They are caught during the month of May, either early in the morning or late at night, when the cold renders them less active; to undertake their removal in the daytime would be a serious measure. Those who gather them cover their faces and guard their hands with gloves, then shake them from the bushes over sheets, and kill them immediately by immersion in vinegar, or by exposure to the vapor of vinegar, spirit, or oil of turpentine. Hager recommends the use of carbon disulphide for this purpose; 7 Cm. to each liter of cantharides in bulk. Thus they are left in a closed vessel for one day. They are then quickly dried in the sun, or with artificial heat which, as stated above, should never rise above 40° C. (104° F.). They are best dried by placing them over caustic lime at a temperature of from 25° to 30° C. (77° to 86° F.).

In the dried state the flies may be known by the preceding descriptions as to color, form, odor, and taste; they are easily reduced to a dirty, grayish-brown powder, dotted with numerous brilliant green points. These points consist of the elytra, head, etc., and do not readily decompose, even when mixed with decaying animal matters. Orfila has recognized these particles in a body nine months after interment. The vesicating property of the flies may be preserved for many years, if they are kept from moisture in well-stoppered bottles, powdering them only as required. If purchased in powder they may have lost their activity, or suffered from adulteration with euphorbium, capsicum, or with some other insects. To preserve them from insects, various means have been advised, as the introduction of a few lumps of camphor into the vessel containing them, or the addition of carbonate of ammonium, or a few drops of strong acetic acid. Chloroform vapor is said to excel them all. Exposing them for ½ hour in glass bottles, to the heat of boiling water, destroys the insects and eggs, without impairing the virtues of the flies; of course they must not be allowed to come in contact with the water. The properties of the fly are much diminished by the insects which feed upon them.

Chemical Composition.—Cantharides powder yields its active properties to boiling water, acetic acid, alcohol, proof-spirit, ether, the fixed and volatile oils. The active principle is a white, crystalline substance termed *cantharidin*. It is in small, white, pearly prisms, or scaly crystals, which are neutral, practically insoluble in water and cold alcohol, but soluble in ether, benzol, chloroform, acetone (E. Dietrich), alkaline solutions, acetic acid, acetic ether, the oils, wood alcohol, and in boiling alcohol, which deposits it upon cooling, and is insoluble in carbon disulphide; it fuses at 98.8° C. (210° F.), volatilizes at a higher heat without decomposition, and evaporates slowly at ordinary temperatures. It is said to exist principally in the trunk and soft parts of the body, and may be obtained by exhausting powdered cantharides with cold rectified spirit by percolation, concentrating the tincture till most of the alcohol is expelled, and allowing the residue to rest for a long time until crystals form. It may be freed from impurities by elutriation with a little cold rectified spirit, which scarcely acts on crystallized cantharidin; and it may be obtained quite pure by redissolving them in boiling rectified spirit, adding animal charcoal, and recrystallizing them by rest and cooling. Ether is, however, preferred to alcohol in preparing these crystals, as it dissolves less of the green oil, which is very difficult to separate. E. Dietrich (in 1880), has obtained cantharidin in brilliant white crystals by dialysis. The yield was above 0.28 per cent. The composition of cantharidin is represented by $C_{10}H_{12}O_4$, or according to Krafft (1877), $C_{20}H_{24}O_8$. It may likewise be prepared by macerating, at three consecutive times, very finely bruised cantharides, for

24 hours, in a sufficient quantity of chloroform, and then removing this by distillation. The green, thick residue is then treated by carbon disulphide, which dissolves the fatty matter. Throw the whole on a filter, which retains the crystallized cantharidin, which may be purified by several solutions in chloroform (W. Procter, A. Fumouze, M. Mortreux). Baudin (*Am. Jour. Pharm.*, 1889), found 1 per cent total cantharidin, of which 0.72 per cent is abstracted by pure chloroform and 0.3 per cent by chloroform acidulated with 2 per cent of hydrochloric acid. M. Fumouze does not consider cantharidin to be the active vesicating principle of the flies; some cantharides 8 or 10 years old, from which he could obtain no appreciable amount of cantharidin, nevertheless, produced prompt vesication when applied to the skin.

Cantharides contain, besides cantharidin, a green oil, soluble in alcohol, black matter, soluble in water, insoluble in alcohol; a fatty matter, insoluble in alcohol, a yellow viscid substance soluble in water and alcohol, yellow matter soluble in ether and alcohol, free acetic and uric acids, phosphates of calcium and magnesium, etc. (P.). Formic acid is said to be present also (E. Dietrich, 1883). This acid is the best solvent for cantharidin, and this fact may explain why decoctions and alcoholic preparations of cantharides are active, as cantharidin, which is generally believed (against Fumouze) to be the vesicating agent, is practically undissolved by water or by cold alcohol. Others explain the solvency of cantharidin in decoction and tincture as being due to its being combined in the beetle, with the yellow matter, which is dissolved by both alcohol and water. The best menstruum (for ordinary use), for cantharides, is chloroform, or ether, which dissolves only the active constituents. Cantharides, in powder or tincture, is sometimes used criminally for aphrodisiac purposes, and is administered to the female victim in coffee, chocolate, brandy-punch, wine, porter, ale, etc. If any particle of the flies is present, the microscope will detect it; otherwise, the only resource left is to ascertain whether cantharidin is present in the suspected liquid. The best test in such a case is to demonstrate its vesicating power. According to C. R. C. Tichborne, Esq., this may be accomplished by the following process: To ½ pint of the suspected fluid add 1 fluid ounce of chloroform (or in like proportion with smaller quantities), and allow it to stand 24 hours, frequently agitating; then allow the mixture to subside, carefully separate the chloroform with a funnel, and filter it through bibulous paper; evaporate the chloroformic solution, spontaneously, in a watch glass, to dryness. A small pellet of lint about half the size of a pea, made loose by teasing out the fibers, and moistened with a drop of olive oil, is gently rubbed over the surface of the watch glass so as to mop off the whole of the film of extractive matter, then applied upon the arm, covered with a piece of goldbeater's skin, and allowed to remain on the arm for 3 or 4 hours. Then remove the lint, wipe off the surface of the arm upon which it had been applied, with chloroform, and if the suspected fluid contained cantharides, rubefaction and vesication will be observed. By this process, 1 grain of cantharides, equal to about $\frac{1}{250}$ of a grain of cantharidin, may be detected in solution.

Cantharidin ($C_{10}H_{12}O_4$), is an anhydride of *cantharidic acid* ($C_{10}H_{14}O_5$), which forms a line of salts called cantharidates. When these salts are warmed with an acid, cantharidin is regenerated as an insoluble compound. Cantharidin, by prolonged heating with hydriodic acid, is converted into *cantharic acid* ($C_{10}H_{12}O_4$), a crystalline monobasic acid to which the double formula ($C_{20}H_{24}O_8$), was assigned by Krafft, its discoverer. A solution of this substance in glycerin does not vesicate. All these compounds are derivatives of the hydrocarbon $C_6H_6(CH_3)_2$, which is a hydrogen addition product of *ortho-xylene* or *ortho-dimethyl benzene*.

Action, Medical Uses, and Dosage.—In large doses cantharis is narcotic and irritant; in medicinal doses, stimulant and diuretic. The earliest symptom produced by the smaller dose is irritation of the genito-urinary tract, and if continued, or the dose be larger, strangury with burning pain, and voiding of bloody and albuminous urine results. In large doses, its use is dangerous, being attended often by constriction and difficulty in swallowing, and by violent inflammation of the alimentary canal and urinary organs, strangury, irritation of the sexual organs, and in the female, abortion; also, redness of face, heat, hurried respiration, quick, small pulse, headache, delirium, tremors, tetanic convulsions, and coma. Burning pain is felt in the stomach, and nausea and vomiting follow, with abdominal tenderness, violent griping and purging, the stools being bloody or fibrinous. Ptyalism is excessive, there is a cadaverous odor to the breath, and burning thirst is prominent. Upon the genito-urinary tract its effects are very severe, causing severe burning pain in the kidneys and bladder, with first an increased, then a diminished, flow of urine, with constant urging to urinate, and the act attended with great difficulty, the water passing drop by drop. In the male priapism occurs, and occasionally satyriasis and seminal emissions. In the female, genital heat and irritation are characteristic, and sometimes abortion occurs. Genital gangrene may also result. Applied externally, heat, redness, pain, serous effusion, and vesication occur. The serum is albuminous, of a yellowish hue and alkaline reaction. If continued too long, or even until complete vesication has occurred, serious sloughing, and often gangrenous ulceration may occur, and particularly so after measles, typhoids, and in low vital states. Post-mortem examination reveals enlarged and engorged kidneys, with desquamative nephritis generally, though the parenchymatous form is sometimes observed, The bladder membranes are red, blistered, or ulcerated, or coated with false membranes. The gastric, as well as the urinary surfaces, are bloody, congested, or inflamed, and present exudates, or are gangrenous. Twenty-four grains of the powder or 1 ounce of the tincture have produced alarming symptoms, and even death. The smallest dose of the tincture of cantharides which has been known to destroy life was 1 ounce, equal to 6 grains of powdered cantharides. There is no known antidote to its poisonous effects, which must be treated on general principles.

Internally, cantharis, in small medicinal doses, acts as a stimulant to the urinary organs. In minute doses it relieves *vesical irritation*, and this is its best use. Cantharis is sometimes given in *chronic gonorrhœa*, *gleet*, *leucorrhœa*, *seminal weakness*, *paralysis*, and *chronic inflammation of the bladder*. In *cystitis* it is valuable to relieve teasing and tenesmus; and in the daytime *enuresis* of women, due to partial sphincter paralysis, it serves a useful purpose when given in minute doses. ℞ Specific cantharis gtt. x; aqua, fl℥iv. Mix. A teaspoonful every hour. It has also been reputed useful in the anasarcous swellings succeeding *scarlatina*, *diabetes*, *scaly cutaneous eruptions*, *chronic eczema*, *incontinence of urine*, *amenorrhœa*, etc. Thirty drops of solution of potassa, given every hour, is said to be an effectual remedy in cantharidal strangury (see *Tinctura Cantharidis*).

Externally, cantharides cause redness, vesication, suppuration or sloughing, according to the length of contact with the integuments. Their most general use is to produce vesication. Blisters are sometimes beneficial in *tic-doloreux*, *sciatica*, *local chronic inflammations*, *diseases of the brain*, *chest*, and *abdomen*, to excite the languid action of vessels, in *retrocession of exanthematous affections*, and to rouse from general defective sensibility, as in *typhoid fever*. In their application to children, much care should be observed, especially in typhoid conditions, exanthemata, and where a tendency to sloughing exists. As a rule, blisters are not well thought of by the majority of our practitioners, though occasionally they are deemed of value. A piece of white paper soaked with cantharidin, which is greenish and liquid, laid on the part, and covered with a compress, and confined by means of a bandage, will vesicate in 3 or 4 hours. A vesicating oil has been recommended by E. Dupuy, prepared as follows: To 1 part of pulverized cantharides add, in a close vessel, a mixture of chloroform and castor oil, of each, by weight, 1½ parts; after some hours, transfer the ingredients to a glass apparatus, and displace the liquid in the usual way; it will amount to about two-thirds of the original bulk of the liquid employed. A few drops of this vesicating oil applied to the arm of an adult will produce a perfect blister in about 8 hours. It is easy of application on any surface, holds the vesicating agent free from the disagreeable concomitants of the ordinary fly blister, and retains the cantharides in a soluble state. Its action will probably be favored by the use of oil silk over the application of it to the skin. Cantharidal collodion is now generally preferred to other vesicating preparations of cantharis.

The dose of powdered cantharides is from ½ to 2 grains; of specific cantharis, 3 to 10 drops in water; tincture of cantharis, 10 to 60 drops, 4 times a day. For specific purposes the minute dose is preferred.

Specific Indications and Uses.—Vesical irritation, partial sphincter paralysis, with dribbling of urine and teasing desire to urinate, accompanied with tenesmus.

Vesicating and Other Medicinal Insects.—*Cantharis vittata*, Latrielle; *Potato fly.*—The potato fly is common to this country, being found principally below 39° north latitude; it appears in July and August, and feeds upon the potato plant. Some seasons the fly exists in great numbers. It resembles the Spanish fly, though somewhat smaller, generally not exceeding half an inch in length. The potato fly, though not so much employed as the Spanish fly, is an excellent substitute for it; indeed, its effects are found to take place more promptly than with the foreign insect, which is probably due to its more recent state. There are several other species of the blistering fly in the United States, which are probably not at all inferior to cantharides, as the *Cantharis cinerea*, *C. atrata*, *C. marginata*, *C. vulnerata*, *C. melæna*, *C. Nuttalli*, and other species. The *Mylabris bifasciata*, from the Cape of Good Hope contains a large amount of cantharidin (Braithwaite, *P. J. Proc.*, xviii, p. 246). *Mylabris cichorii* and *M. lunata* are also vesicant. The former is reputed, in Salamis, a cure for *hydrophobia*, and is thought to have been the ancient cantharis. This species and *M. phalerata*, have occurred in commerce as *Chinese blistering flies*. The *Lytta Gigas* of the East Indies has also been a commercial commodity. These species all contain considerable cantharidin.

These insects may be used in all cases as substitutes for the Spanish fly, as the property they all posses of blistering the skin when in contact with it, is due to the same constituent. The doses will also be the same.

Ænas afer, of Spain, an insect of the beetle order, is said to be fully as great a vesicant as cantharis, and possesses besides, the advantage of operating almost painlessly and without any irritant action upon tho renal organs (*Br. Med. Jour.*, 1882).

Blatta orientalis, Linné, *Cockroach.*—A revived ancient remedy, having been of late years brought forward in Russia as a non-irritating diuretic for *albuminuria* and other *dropsical complaints*. The ancients employed a preparation of the insect in oil in various *cutaneous maladies.* The active principle, which is crystalline, and known as *antihydropin* (or *taracanin*), is said to have been isolated by Bogomolow in 1876.

Formica rufa, Linné, *Red ant.*—This insect, which contains formic acid, and from which the latter was first isolated, enters into some European pharmaceutical preparations. Thus the *German Pharmacopœia* has *Spiritus Formicarum*: Alcohol 70, water 26, and formic acid 4 parts. Mix. Dose, 20 to 60 drops. It forms an acid liquid without color. A *Tinctura Formicarum* is made by taking alcohol 3 parts, and fresh, bruised red ants 2 parts. Digest. This produces a tincture having a brown color. Baths prepared by adding to the water a decoction of red ants was once used in *rheumatic* and *gouty complaints*. The spiritus formicarum is employed in Germany internally and locally in *paralytic* and other *nervous disorders.*

CAPSELLA.—SHEPHERD'S PURSE.

The dried plant of *Capsella Bursa-pastoris*, Mœnch (*Thlaspi Bursa-pastoris*, Linné).

Nat. Ord.—Cruciferæ.

COMMON NAMES: *Shepherd's purse*, *Shepherd's sprout.*

ILLUSTRATION: *American Dispensatory*, 8th ed., Plate 5.

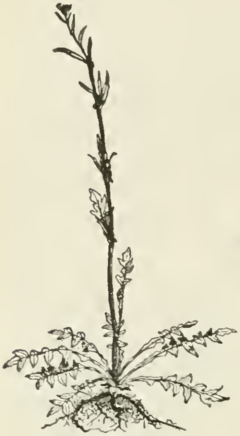
Botanical Source.—This is an annual weed, the stem of which is erect, striate, about 12 inches high, where the plants grow apart, but in rich soil, where they are in patches, the stems are often over 2 feet long, and reclining, but the thickness is increased very little. The branches are few, remote, and generally simple. The leaves are mostly borne in a thick radical cluster, at the base of the stem, and recline on the ground. They are from 3 to 6 inches long, and pinnatifid, with from 9 to 15 acute, wedge-shaped segments. The stem leaves are few, shorter than the internodes, and clasp the stems at the base of the branches. The lower stem-leaves are sagittate and dentate; the upper, linear and entire. The flowers are small, white, and borne in terminal racemes, which elongate as the flowers expand. The sepals and petals are 4, and the stamens are 6 and tetradynamous. The fruit is a flat, wedge-shaped pod, notched at the end, and divided by a narrow partition, into 2 cells, which contain numerous minute, oblong seeds.

History.—Shepherd's purse is a native of Europe, but is naturalized in almost every country of the world. In the United States it has become among the most common of yard weeds, growing in all sections of the country, and often forming large patches in waste grounds. It is especially luxuriant in the spring months, but the stem dies and the weed entirely disappears by the middle of summer. It is often eaten in the spring as "greens."

Capsella Bursa-pastoris has been used in domestic medicine since an early day. Culpepper refers to it in his *English Physician*, and the article is copied almost verbatim in subsequent works, until Lewis' (1761) *Materia Medica* cast discredit upon it as an astringent.

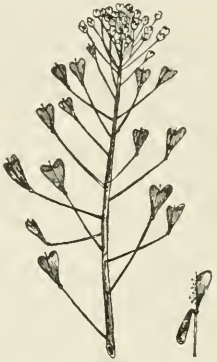
Description and Chemical Composition.—Shepherd's purse has been described above (*Botanical Source*). It has an herbaceous, unpleasant odor when fresh, if bruised, and a pungent, biting taste, which is lost by drying. The herb contains a resin and a volatile oil; the seeds yield proteid substances, a fixed oil, and a volatile oil said to be identical with the volatile oil of mustard. But no satisfactory analysis has yet been made of its chemical constituents.

Fig. 55.



Capsella Bursa-pastoris.

Fig. 56.



Fruit of Capsella.

Action, Medical Uses, and Dosage.—Shepherd's purse appears to possess mild stimulating, astringent, and diuretic properties, and the fresh herb is decidedly more active than the dried. In *urinary derangements* of *renal* or *cystic* origin, and in *hematuria*, an infusion, and especially a tincture of the herb, will be found very efficient. It has likewise been used with some success as an expectorant and for the promotion of the catamenial flow in cases of *simple amenorrhœa*. It is a remedy for *chronic menorrhagia*, with too frequent and too long-continued or constant, but almost colorless, flow. Associated with this condition is a frequent urging to urinate, and a deposit of phosphates. *Atonic dyspepsia* and *chronic diarrhœa* have been successfully treated with it. In *bleeding piles*, *diarrhœa*, and *dysentery*, it is stated to have been found beneficial. The dose of the infusion is from 2 to 4 fluid ounces, but its best forms for administration are the specific medicine, a tincture, or fluid extract of the herb; the dose of the tincture is 1 or 2 fluid drachms every 2 or 3 hours; of the fluid extract, from 20 to 60 minims; of specific capsella, 1 to 30 drops. The fresh herb, bruised and applied locally, has been effectual in *ecchymosis*, the result of blows, bruises, etc., and has been of service in *rheumatic pains*.

Specific Indications and Uses.—Chronic hemorrhages; menorrhagia with too frequent and long continued, or constant, colorless discharge; indigestion from atony; chronic diarrhœa; constant desire to urinate, with deposits of phosphates.

Related Species.—*Lepidium virginicum*, Linné, *Pepper-grass, Tongue-grass.*—An allied weed found in similar locations, has often been confounded with capsella, and has been lately figured for it in one of the medical journals. Pepper-grass has an erect, much-branched stem, about a foot high. The leaves are numerous and much more toothed than the stem leaves of capsella. The fruit is an orbicular, flattened pod, divided into 2 cells by a narrow partition, and containing 2 rather large seeds. Pepper-grass has a much sharper and more pungent taste than capsella. This and the next species probably contain a sulphuretted essential oil.

Lepidium intermedium, Gray; North America. *Wild pepper-grass.*

Lepidium sativum, Linné, *Garden pepper-grass, Garden cress.*—Habitat, Asia. Cultivated in Europe and America for table use. Contains a volatile, sulphuretted oil, and myrosin.

Lepidium campestre, Linné, *Yellow-seed*, and *Lepidium ruderale*, Linné, *Pepper-grass.*—Acrid plants with the same constituents as the preceding species.

Lepidium Iberis, Linné, *Pepper-grass.*—Southern Europe to northern Asia. Contains *lepidin*, a bitter, amorphous body obtained from the flowers and seeds (Leroux, 1837), and a volatile, sulphuretted oil.

Lepidium latifolium, Linné, *Broad-leaved pepper-wort.*—Properties similar to last species.

Thlaspi arvense, Linné, and *Thlaspi campestris*, Linné; Europe and America; known as *Penny cress* and *Mithridate mustard;* have brown, alliaceous seeds which yield an oil which Pless declares to be a mixture of oils of mustard and garlic.

Iberis amara, Linné, *Bitter candy-tuft.*—This plant has a herbaceous stem about a foot in height, with lanceolate, acute, somewhat toothed leaves, and white flowers, corymbed, but becoming racemed. Silicles obcordate, narrowly emarginate; cells 1-seeded (W.). This is a small annual, common to Europe, where it is admired as an ornamental plant; its beautiful white flowers appearing in June and July. The whole plant is reputed medicinal, the seeds more especially. In overdoses it occasions vertigo, vomiting, and purging, without accomplishing any valuable result. Medicinally, it appears to control *nervous* and *vascular excitement*, and has been found efficient in *enlargement of the heart*, and some affections of the air-tubes. It is also said to have been beneficially administered in *rheumatic*, *gouty*, and *dropsical affections*. The dose is from 1 to 5 grains of the powdered seeds.

Cochlearia officinalis, Linné, *Scurvy-grass*, *Spoonwort* (*Herba cochleariæ*). Europe. An acrid, bitterish, pungent plant when fresh. It contains the common plant constituents with a bitter body, tannin, salts, and gives rise to an essential oil (*oil of scurvy-grass*), not pre-existent in the plant. A. W. Hoffmann demonstrated that it was composed mainly of *butyl-iso-sulphocyanide* ($CSN.C_4H_9$). An oil of like composition, but having a different odor, is synthetically prepared from butylamine ($C_4H_9.NH_2$). It differs also in the fusing point of the addition compound it forms with ammonia, 90° C. (192° F.), while the corresponding compound of the former ($CS.[NH_2].NH[C_4H_9]$), melts at 135° C. (275° F.). The plant is sometimes used as a salad. It is stimulant, antiscorbutic, and diuretic. It is very valuable in *scurvy* when eaten fresh, and the juice in water makes a good wash for *spongy gums* and *buccal ulcerations*.

Cardamine pratensis, Linné, *Cuckoo-flower* (*Herba nasturtii pratensis*).—A bitterish, pungent perennial found in Asia, Europe, and sparingly in North America. The showy flowers are of a white or rose color. The virtues of the plant are due to an essential oil, probably analogous to oil of mustard, as the seeds are said to contain *myronic acid*. The characteristics of the plant are lost upon drying. Diuretic, antispasmodic, and antiscorbutic. Has been used in *chorea*, *asthma*, *dropsy*, *bronchitis*, *intermittent fever*, *laryngitis*, and *scaly skin affections*, and locally to *cancer* and other *sores*.

Cardamine hirsuta, Linné. *Small bitter cress* of Europe and North America, and *Cardamine amara*, Linné, *Bitter cress* of Europe, have properties somewhat like the preceding.

Dentaria diphylla, Linné, of North America, and several other species of Dentaria, are known as *Toothwort* and *Pepperwort*, the rhizomes of which have a pungent taste. Of the European species there may be mentioned the *D. enneaphylla*, Linné, and *D. bulbifera*; of the American, *D. laciniata*, Mühlenberg, *D. heterophylla*, Nuttall, and *D. maxima*, Nuttall.

Barbarea vulgaris, Robert Brown, *Yellow scurvy-grass*, *Winter cress*, *Yellow rocket*.—Frequently cultivated as a salad, as is also the *Barbarea præcox*, R. Brown, or *Early winter cress*. Both are found in Europe and North America.

Nasturtium officinale, R. Brown (*Sisymbrium Nasturtium*, Linné), *Water cress*.—Common in wet places. Pungent and bitterish when fresh, and contains a sulphuretted essential oil analogous to that of mustard. A plant having similar properties is the *Nasturtium palustre*, De Candolle, or *Marsh cress*.

Capparis spinosa, Linné. *Nat. Ord.:* Capparidaceæ. *Caper*.—The caper bush is a trailing shrub growing in northern Africa and Southern Europe. Formerly the root-bark was official. It has a bitterish, sub-acrid, aromatic taste. The bluish-green, entire, round-oval leaves also possess the bitter, acrid taste. The plant is chiefly cultivated, however, for its flower buds, which, when prepared with salt and pickled in vinegar, form a much esteemed condiment. The buds are about the size of a pea, have 4 each of petals and sepals, many stamens, a single ovary, and a sharp, hot taste. When pickled they are sour and burning to the taste. Besides tannin and a bitter body, the root-bark contains a pungent, saponin-like principle. The buds contain an alliaceous, volatile oil, and a yellow coloring body thought to be *rutin* (*rutic acid*) (see *Ruta*). Pickled capers were formerly employed in *scurvy*, and the root-bark in *rheumatic complaints* and *amenorrhœa*.

Capparis ferruginea, Linné, and *Capparis cynophallophora*, Linné. West Indies. Root-bark vesicant and diuretic; fruit used in *scurvy*; all parts have been used in *hysteria* and to expel *worms*. The Eastern species, *Capparis Ægyptiaca*, Lamarck, and *Capparis coriacea*, have similar uses. The African fruit of *Capparis ledada*, Robert Brown, and other species, are used as substitutes for pepper.

Reseda Luteola, Linné. *Nat. Ord.:* Resedaceæ. *Dyer's weed*, *Weld*. Europe. Naturalized in the United States. The root of this plant is conical, and resembles in taste and odor the garden radish. It contains allyl-sulphocyanate (C_3H_5CNS), or volatile oil of mustard (Volhard). A persistent bitter taste is imparted by the herb. It contains silky yellow crystals of a coloring body, *luteolin* ($C_{20}H_{14}O_8$). It is feebly bitter and somewhat astringent. It is quite soluble in alcohol, and less so in ether and water. Fused with caustic potash it yields protocatechuic acid, phloroglucin, and carbon dioxide. It is now used only in dyeing; formerly it was employed to increase the renal and cutaneous secretions.

Reseda odorata, Linné, *Mignonette*. Its root also contains the volatile oil of mustard, or allyl-sulphocyanate.

Polanisia graveolens, Rafinesque. *Nat. Ord.:* Capparidaceæ. North America, from Vermont to Arkansas, in gravelly soil. An annual bearing small yellowish-white flowers and ternate leaves, and many-seeded, oblong-lanceolate pods. The whole plant is viscid-pubescent and has a pungent taste and disagreeable odor. It is an irritant.

Gynandropsis pentaphylla, De Candolle. *Nat. Ord.:* Capparidaceæ. East Indies. Naturalized in this country, growing in waste places from Virginia to Georgia. Flowers white; capsule linear and containing numerous seeds, which have been used like mustard.

Tropæolum majus, Linné, and *Tropæolum minus*, Linné. *Nat. Ord.:* Geraniaceæ. *Garden nasturtium*, *Indian cress*. Natives of Peru. Cultivated for ornament and for the buds and immature fruits, which are used in pickling.

Other Cresses.—*Spilanthes oleracea*, Jacquin (Compositæ), is *Para cress; Arabis lyrata*, Linné (Cruciferæ), is *Rock* or *wall cress;* and *Senebiera didyma*, Persoon, is *Wart cress* and *Swine cress* (see also *Sinapis*).

CAPSICUM (U. S. P.)—CAPSICUM.

"The fruit of *Capsicum fastigiatum*, Blume" (*U. S. P.*), (*Capsicum minimum*, Roxburgh).

Nat. Ord.—Solanaceæ.

Common Names: *Cayenne pepper, African pepper, Bird pepper, Guinea pepper*, or *Chillies* (in England), *Red pepper.*

Illustration: Bentley and Trimen, *Med. Plants*, 188.

Botanical Source.—This plant differs from the next species in being a shrub instead of an herbaceous annual, and in having the corolla lobes more sharply pointed, and differs also in fruit and seed. The fruits, 2 or 3 in number, are borne where the branches fork. They are from ½ to less than 1 inch long, narrow, somewhat oblong-ovoid, erect, sub-cylindrical, of bright scarlet-red color, and are borne on a flat cup-like calyx. The fruit is hot, extremely pungent, or biting, and has a characteristic odor. Its seeds are smaller than those of *Capsicum annuum*, Linné, a description of which is here added.

Capsicum annuum, Linné, *Pod pepper.*—An annual plant, of a dark-green color, almost smooth, and growing 1 or 2 feet high. The stems are herbaceous, angular, furrowed, and branched. The leaves are ovate or oblong, acuminate, entire, on long petioles, and sometimes hairy on the veins underneath. The flowers are white, solitary, axillary, pendulous, with dark-colored oblong anthers; the calyx angular, erect, persistent, with 5 short acute lobes; the corolla hypogynous, rotate, 5-lobed; the corolla-tubes very short; the lobes spreading. Stamens 5; ovaries ovate; style filiform; stigma blunt. The fruit is of various forms, round, oblong, cordate, or horned, and either of scarlet or yellow pods, smooth, shining, and 2-celled, containing numerous flat, dry, reniform, very acrid seeds (L.).

History.—There are several species of Capsicum, all varying more or less in their degrees of pungency. The only plant now recognized by both the *United States Pharmacopœia* and the *British Pharmacopœia* is the *C. fastigiatum*, Blume. The botanical description of the *Capsicum annuum*, Linné, is here included, because often employed for the same purposes as the official species, and on account of its being largely cultivated in American gardens. Furthermore, it is the official species of the *Pharmacopœia Germanica.* It undoubtedly forms a large part of ground red pepper. The official capsicum grows on the Guinea coast and the East Indian Isles.

There are several other species of Capsicum, as the *C. frutescens*, Linné; *C. longum*, Linné; *C. cordiforme*, Miller; *C. grossum*, Willdenow; *C. chlorocladum*, De Candolle; *C. cerasiforme*, Willdenow, etc. Many of them, however, are regarded as mere varieties. They are natives of the East and West Indies, and of most hot climates throughout the globe. Several species are cultivated in the United States, flowering from June to September, and maturing their fruit in the latter part of autumn. A good variety is found indigenous in Texas. They all agree in producing a shining vesicular berry of a greenish, yellowish, cherry-red, or most generally scarlet color, consisting of a thin, fleshy, inflated, bilocular, or trilocular capsule, and many small, flat, reniform seeds. The Bird pepper (*C. fastigiatum*, Blume) is usually deemed the best. The *C. annuum*, Linné, is the most extensively used in this country. The large ovate peppers are pickeled while green. All the varieties of capsicum have a faint, characteristic odor, and an extremely hot, acrimonious taste, which in some is so intense that the smallest fragment, when chewed, will excite a sensation of intolerable burning in the mouth. This acridity is imparted to hot water, ether, spirit, vinegar, and fixed oils. Powdered cayenne pepper, of good quality, is of a bright color, varying from a beautiful red to a brown or yellow, which is considerably discolored by the action of light. Insects will attack it.

Adulterations.—Powdered capsicum is sometimes adulterated with pulverized woods or barks, red ochre, and minium (red lead). This last may be discovered, by steeping the capsicum in nitric acid diluted with water, then adding sodium sulphate to the filtered solution, which gives a white deposit, if the metallic oxide is contained in it.

Description.—"Oblong-conical, from 10 to 20 Mm, ($\frac{1}{3}$ to $\frac{3}{4}$ inch) long, supported by a flattish, cup-shaped, 5-toothed calyx, with a red, shining, membranous and translucent pericarp, enclosing 2 cells, and containing flat, reniform, yellowish seeds attached to a thick, central placenta. It has a peculiar odor, and an intensely hot taste"—(*U. S. P.*).

Chemical Composition.—In 1816 and 1817, Braconnot and Bucholz extracted what they believed to be the active constituent and called it *capsicin*. According to Hager (*Handb. Pharm. Praxis*, 1886), Braconnot gives the following composition of 100 parts of Spanish pepper: Pungent oil, 1.9; wax, combined with red coloring matter, 0.9; brown amylaceous matter, not blued by iodine (pectic acid, according to Berzelius), 9.0; gum, 6.0; nitrogenous matter, 5.0; woody fiber, 67.0; potassium citrate, 6.0; potassium phosphate and chloride, 3.4. *Capsicin* of Braconnot and Bucholz is obtained by making an alcoholic extract of capsicum, and then digesting this in ether, filtering and evaporating the ethereal solution. It is a thick liquid, of a yellowish-red, or reddish-brown color, of an overpowering acrid taste, volatilizes at a moderate elevation of temperature, and disengages so acrid a vapor, that $\frac{1}{2}$ grain will cause every person in a large room to cough and sneeze violently. Water and vinegar slightly dissolve it, but ether, oil of turpentine, alcohol, chloroform, and the caustic alkalies readily dissolve it. With barium oxide it forms a solid, acrid combination (P.—T.). F. Victor Heydenreich (*Amer. Jour. Pharm.*, 1858), concluded that the *capsicin* of Braconnot consisted of two active oils with an inert fatty substance, and that the true capsicin consisted of these oils without the fatty matter. In 1873, Buchheim pronounced *capsicol* to be the active principle which, however, was probably not quite pure (Flückiger). Mr. J. C. Thresh (*Pharm. Jour. and Trans.*, 1876) succeeded in isolating the probably pure acrid principle—a colorless crystalline substance present in small amount only, and difficult to obtain pure—to which he gave the name *capsaicin* ($C_9H_{14}O_2$). It is intimately associated with a fatty material, composed largely of palmitic acid. It is extremely rubefacient, fuses at 59° C. (138.2° F.), sublimes at 115° C. (239° F.), and, when heated, gives off intensely acrid fumes. Alcohol, ether, hot disulphide of carbon, benzin, diluted alkalies, and amylic alcohol dissolve it. In 1889, Arthur Meyer demonstrated that the placenta of Capsicum annuum is the carrier of the acrid principle (*capsaicin*). This isolation was effected by extracting with boiling ether, evaporating the solvent, mixing the residue with oil of sweet almonds (to retain the red coloring matter), extracting with 70 per cent alcohol, evaporating and dissolving the residue in solution of caustic potash free from carbonate, filtering and passing into the filtrate carbonic acid to saturation. After standing for some days the *capsaicin* crystallizes out and is purified by washing with water and cold benzin. This method (which is that of Thresh) yielded 0.9 per cent of *capsaicin* in 110 Gm. of placenta, obtained from 5000 Gm. of red pepper (*Amer. Jour. Pharm.*, from *Pharm. Zeitung*). Felletar (1868), also Thresh (*Amer. Jour. Pharm.*, 1876), and later Flückiger, isolated a volatile, but non-acrid alkaloid of coniïne-like odor. A very small portion of a crystallizable fat, occurring in white crystalline tufts, and associated with essential oil, to which the odor of capsicum is probably due, was obtained by Flückiger (*Pharmacognosie*, 1891). It had a non-acrid, spicy taste, and resembled parsley oil.

Action, Medical Uses, and Dosage.—Capsicum is a pure, energetic, permanent stimulant, producing in large doses vomiting, purging, pains in the stomach and bowels, heat and inflammation of the stomach, giddiness, a species of intoxication, and an enfeebled condition of the nervous power. The infusion is much used in *colds*, *catarrh*, *hoarseness*, etc. In *atonic dyspepsia* and *catarrhal gastritis* it stimulates the nerves of the stomach, promotes the secretion of the digestive juices, and assists peristaltic motion. As an internal remedy some have advanced the theory that it is destroyed during digestion. Perhaps, when ingested with food, this may be partially true, but, if so, how do we account for its remarkable activity in sustaining the nervous system when given in *delirium tremens*, and the power it has in steadying the patient and promoting sound sleep? That its effects are partly due to its stimulating action upon the gastric membranes is unquestionable, but its entire effects can not be due to this cause alone. The same may be said of its action in *congestive intermittent* and *remittent fevers.* Some have thought to attribute its action in *congestive chill* to its effects upon the solar plexus. It forms an excellent addition to quinine in *intermittents*, where there is a deficiency of gastric susceptibility, and it has been asserted that but one-half the quinine will be needed when combined with capsicum.

Capsicum is the very best agent that can be used in *delirium tremens.* It enables the stomach to take and retain food, and the best form of administration is a strong beef tea, or strong soup made hot with red pepper. There is no danger of giving an overdose, as a wonderful quantity (even a drachm of red pepper) may be swallowed with evident pleasure and without ill results by a confirmed dipsomaniac. In the *atonic dyspepsia of dipsomania* it takes the place of alcoholic stimulants, removing the craving for alcoholics and sense of sinking at the pit of the stomach, prevents the morning sickness and vomiting, restores gastric tone and promotes the digestion of wholesome food. It should be administered whenever the desire for drink comes on. Prof. Locke recommends for delirium tremens doses of 10 to 40 grains of capsicum every 3 hours, or liberal doses of compound tincture of myrrh and capsicum. When the craving for drink occurs he administers 20 drops of the following in water: ℞ Comp. tinct. of myrrh, fl℥j; specific nux vomica, flʒss. Mix.

Capsicum is said to reduce irritation and increase capillary activity in *chronic renal congestion.* It affects the bladder and rectum similarly and may accordingly be a remedy for *diarrhœa*, *constipation*, *piles*, and in *dysentery*, where the stools are bloody, the mucus tenacious, with tenesmus and burning, and associated with tenesmic action of the bladder. These cases are those in which there is a lax habit of body with feeble digestion. Other indicated remedies may be given with it. For *hemorrhoids*, with torpor, constipation, or relaxation, it is a good remedy. Prof. Locke suggests for this state, when not recent nor associated with rectal burning: ℞ Capsicum, gr. ij; aloes, gr. ¼. Mix. Make 1 pill.

Capsicum should not be forgotten in *low fevers*, where there is dryness and constriction of the tissues, and the tongue is dry and harsh and there is but little buccal or salivary secretion. Here it is a very valuable adjuvant to other indicated drugs. Though a stimulant, the general circulation is but little increased by capsicum. *Paralytic states*, without organic lesions, and with great digestive and nervous torpor, are often greatly improved by capsicum. In *Asiatic cholera* and *angina pectoris*, with cold extremities, cool perspiration, and great nervous prostration, it is asserted a saving agent.

Capsicum meets the debility of young and old, but is particularly useful in old people when the body-heat is low, vitality depressed, and reaction sluggish. *Tired*, *painful muscles*, *stiffened joints*, and relaxation of any part are common conditions in the elderly that are, in a measure, rectified by capsicum. Homœopathists suggest its use in *pneumonia* when abscesses threaten. *Flatulence* in dyspeptic states may be dispelled by capsicum.

A preparation made by adding ½ ounce of powdered capsicum and 2 drachms of salt, to ½ pint each, of vinegar and water, has been found an excellent anti-emetic, in all cases of *vomiting* or *nausea.* To be given in tablespoonful doses as often as required. It has received the name of ANTI-EMETIC DROPS. Capsicum has been also used in *spasmodic affections*, *passive hemorrhages*, especially uterine, and, when combined with the compound powder of ipecacuanha will, in many instances, promptly arrest *hemorrhage after parturition.*

Externally, the infusion and tincture have been found valuable as a stimulating gargle in the *ulcerated throat of scarlatina*, or in *chronic cynanche tonsillaris;* also as a counter-irritant, as an application to *indolent ulcers*, in *chronic ophthalmia*, and in *chronic* or *indolent ulceration of the cornea.* If used early in *tonsillitis*, with relaxation, it may abort the trouble, but if it does not its use should be discontinued until the active inflammation has subsided. *Hoarseness*, from atony of the vocal cords, is relieved by it, and it is a remedy for *relaxed uvula.* It enters into various tinctures and liniments. The concentrated tincture of capsicum has been highly recommended in the treatment of *chilblains* and *toothache.* In the former, a piece of sponge or flannel must be saturated with it, and rubbed well over the seat of the chilblain, until a strong tingling and electrical feeling is produced. This application should be continued daily, until the disease is removed; relief will be experienced on the very first application, and frequently there will be a total removal of the disease after the second or third application. This, however, will depend upon the severity of the case.

Powdered capsicum, sprinkled inside the stockings, was a favorite prescription with Prof. Scudder for *cold feet*. This medicine possesses an extraordinary power in removing congestion by its action upon the nerves and circulation; if the skin is not broken, it never causes excoriation by rubbing with it. For *toothache* from dental caries, place 1 or 2 drops of the tincture on cotton, and apply to the affected part; the relief will be immediate. *Tinctura Capsici Concentrata* is prepared by macerating 4 ounces of capsicum in 12 fluid ounces of rectified spirit for 7 days; then filter.

The *ethereal oil of capsicum*, prepared by the evaporation of a saturated ethereal tincture of the pods, is sometimes used as a rubefacient. It is of a brilliant yellowish color, with a peculiar odor and aromatic taste, and filled with crystals of solid fatty oil of curious dendroid forms (see *Oleoresina Capsici*).

Capsicum may be used wherever a pure stimulant is indicated, in all cases of diminished vital action, and may be combined beneficially with other remedies, in order to promote their action, as emetics, cathartics, diaphoretics, tonics, etc. Dose of the powder, from 1 to 6 grains; of the tincture, from ½ to 1 fluid drachm.

Specific Indications and Uses.—Marked depression and debility; atonic dyspepsia of drunkards; delirium tremens; colic, with abdominal distension; congestive chills; cold extremities, with blanched lips and small, weak pulse; congestion, with capillary atony; tongue dry and harsh, and buccal and salivary secretions scanty, in fevers; chronic hemorrhoids, from relaxation.

CARBO ANIMALIS (U. S. P.)—ANIMAL CHARCOAL.

"Charcoal prepared from bone"—(*U. S. P.*).

SYNONYMS: *Bone-black*, *Ivory-black*, *Spodium*, *Carbo ossium*, *Ebur ustum*.

Preparation and Chemical Composition.—When bones, or indeed any animal substances, are exposed to a red heat, with limited access of air, in covered iron vessels, or retorts, until they cease to emit any vapor, the residue is animal charcoal. *Bone spirit*, an ammoniacal fluid, is also obtained by this process of of destructive distillation, from the vapor which passes over. The animal charcoal or bone-black thus obtained is impure, and though serviceable for some purposes in pharmacy and in the arts, yet it will be found unfit for many others unless purified. The impurities it contains are mainly phosphate and carbonate of calcium, with carbide and silicide of iron, and sulphides of iron and calcium. The amount of inorganic constituents is as high as 85 per cent, leaving for pure carbon not more than 15 per cent. Sand also is frequently present.

CARBO ANIMALIS PURIFICATUS (*U. S. P.*), *Purified animal charcoal.*—"Animal charcoal in No. 60 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; hydrochloric acid, three hundred grammes (300 Gm.) [10 ozs. av., 255 grs.]; boiling water, a sufficient quantity. Introduce the animal charcoal into a capacious flask, add two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.], of hydrochloric acid, and one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏], of boiling water, and connect the flask with an upright condenser. By means of a sand bath keep the mixture gently boiling during 8 hours. Then add five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of boiling water, transfer the mixture to a muslin strainer, and when the liquid has run off, return the charcoal to the flask. Add to it one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] each, of hydrochloric acid and of boiling water, boil for 2 hours; again add five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of boiling water, transfer the whole to a plain filter, and when the liquid has run off, wash the residue with boiling water, until the washings give only a faint cloudiness with silver nitrate test solution. Dry the powder in a drying oven, and immediately transfer it to well-stoppered vials"—(*U. S. P.*).

Description and Tests.—I. CARBO ANIMALIS (*U. S. P.*), *Animal charcoal.*—According to the Pharmacopœia, carbo animalis should be in "dull black, granular fragments, or a dull-black powder, odorless, nearly tasteless, and insoluble in water or alcohol. When ignited, it leaves a grayish or yellowish-white ash, amounting to about 85 per cent of the original weight of the portion taken, which should have been previously dried at 120° to 125° C (248° to 257° F.), to a constant weight. The ash should be soluble in hydrochloric acid with the aid of heat, leaving not more than a trifling residue. If 1 Gm. of animal charcoal be boiled for several minutes, with a mixture of 3 Cc. of potassium hydrate T.S. and 5 Cc. of water, the filtrate should be colorless or nearly so (evidence of complete carbonization)"—(*U. S. P.*).

II. CARBO ANIMALIS PURIFICATUS (*U. S. P.*), *Purified animal charcoal.*—"A dull black powder, odorless, tasteless, and insoluble in water, alcohol, or other solvents. If 2 Gm. of the powder be ignited at a red heat with free access of air in a broad shallow porcelain or platinum dish, it should not leave a residue weighing more than 0.08 Gm., or 4 per cent of the original weight (limit of silicates and other fixed inorganic matter). If 1 Gm. of the powder be boiled with a mixture of 3 Cc. of potassium hydrate T.S. and 5 Cc. of water during 3 minutes, the filtrate should be colorless (evidence of complete carbonization)"—(*U. S. P.*).

Purified animal charcoal somewhat resembles vegetable charcoal, but is more dense, and less combustible. Upon long exposure to the atmosphere it absorbs moisture, and loses its decolorizing properties, for which it is chiefly employed. The nature of its decolorizing action is not well understood, though supposed to be largely owing to its peculiar porous texture. It not only removes the coloring principle of vegetable infusions and tinctures, but is likewise capable of absorbing bitter principles, and when purified, abstracts iodine and numerous salts from their watery solutions. When carelessly purified, animal charcoal may contain phosphate and carbonate of calcium; these impurities may be detected by effervescence with hydrochloric acid, and the precipitation of phosphate of calcium from the filtered solution by ammonia, or of carbonate of calcium by carbonate of ammonium. H. Leplay and J. Cuisinier have given a method of restoring, by easy and speedy methods, the absorbing properties that animal charcoal loses by use (*Amer. Jour. Pharm.*, 1862, p. 551, from *Chem. News.*, 1862).

Action, Medical and Pharmaceutical Uses, and Dosage.—Its principal uses are to decolorize various organic matters, as strychnine, cinchonine, etc., and to purify syrups and glucose. It is used extensively in sugar refineries for this purpose. It is also used to remove from spirit prepared from grain, its grain- or fusel oil. It has likewise been highly extolled as an internal remedy, in doses of ½ grain to 3 grains, twice a day, in *scrofulous* and *cancerous affections*, *goitre*, *obstinate chronic glandular indurations*, etc. Not used in this country medicinally. Like vegetable charcoal, it destroys the odor of putrid animal matter. Dr. A. B. Garrod, in a paper read before the Medical Society of London, Nov. 17, 1846, recommended purified animal charcoal in cases of *poisoning* by opium, strychnine, aconite, belladonna, stramonium, tobacco, hemlock, etc. First remove as much of the poison as possible by means of the stomach pump, or emetics combined with the antidote, and then give a large quantity of the purified animal charcoal, diffused in warm water; a vegetable emetic must not be used, as the charcoal would destroy its emetic properties. He considered this agent useful as an antidote to arsenous acid. According to M. Lebourdais, animal charcoal may be used for the purpose of procuring many of the active constituents of vegetable medicines (see *London Pharm. Jour.*, 1851, p. 447).

Related Product.—CARBO CARNIS, *Meat charcoal.* This product is prepared by roasting 3 parts of lean veal with 1 part of bones (small ones preferred). The operation is conducted in a covered apparatus, and continued until inflammable vapors cease to be evolved. When cold, it is to be powdered and put into a well-stoppered vial.

CARBO LIGNI (U. S. P.)—CHARCOAL.

"Charcoal prepared from soft wood, and very finely powdered. It should be kept in well-closed vessels"—(*U. S. P.*).

SYNONYMS: *Carbo vegetabilis*, *Carbo præparatus*, *Wood charcoal*, *Carbo e ligno.*

Preparation and Purification.—Wood or vegetable charcoal for pharmaceutical or other purposes is made by the well-known process, too familiar to be described. For medicinal purposes, charcoal as ordinarily prepared is not pure enough for internal use. It may be purified, according to Lowitz, by placing fine common charcoal in a crucible, and, when filled, cementing on a cover containing several orifices. This is to be exposed to a red heat, which must be continued as long as flame of a blue color emerges from the orifices of the cover, and when this has stopped remove from the fire, and when cold place the charcoal as soon as possible in glass vessels, which must be kept well closed. The best charcoal for medicinal purposes is that which is properly prepared from young willow shoots, and is known in trade by the name, "*Willow charcoal.*"

Description.—In shape and texture charcoal resembles the particular wood from which it is prepared. As used in medicine and pharmacy it is in pulverized condition. According to the *U. S. P.* it should be "a black, odorless, and tasteless powder, free from gritty matter. If 1 Gm. of charcoal be boiled with a mixture of 3 Cc. of potassium hydrate T.S., and 5 Cc. of water for several minutes, the filtrate should be colorless, or nearly so (evidence of complete carbonization)"—(*U. S. P.*). Wood charcoal is an excellent conductor of electricity, but not of heat. It corrects the fetor from putrid animal matters, and decolorizes vegetable infusions, but not so promptly as the animal charcoal. It decomposes many metallic compounds, when heated with them, by depriving them of their oxygen. If kept in the air its weight is speedily augmented in consequence of its affinity for moisture, even to the amount of from 10 to 15 per cent. Combustion produces carbonic acid gas, leaving behind an ash composed of earthy matters and carbonate of potassium. Charcoal has the property of absorbing gases, which it accomplishes to an extent varying with the grade of charcoal, and with the gas absorbed. For this purpose it should be freshly prepared. Generally speaking, 1 volume of charcoal will absorb 10 volumes of oxygen, 35 volumes of carbonic acid gas, 55 volumes of hydrogen sulphide, and 100 volumes of ammonia. It is not so useful for decolorizing pharmaceutical preparations as animal charcoal.

Action, Medical Uses, and Dosage.—As a medicine, charcoal should always be purified. "Charcoal is generally described as possessing antiseptic properties, while the very reverse is the fact. Common salt, corrosive sublimate, arsenous acid, alcohol, camphor, creosote, and most essential oils, are certainly antiseptic substances, and, therefore, retard the decay of animal and vegetable matters. Charcoal, on the contrary, greatly facilitates the oxidization, and, consequently the decomposition of any organic substance with which it is in contact. It is, therefore, the very opposite of an antiseptic" (Dr. Stenhouse). It does, however, render the gases evolved latent. It acts as an absorbent (both fluids and gases) and disinfectant. Its internal employment will be found useful in those *digestive derangements* which are associated with offensive breath and disagreeable belchings; also to correct the fetid condition of the stools in *dysentery.* It is also useful in *acidity of the stomach, flatulency*, and in the nausea and constipation attending *pregnancy.* It is also very useful in internal heat and irritation of the stomach, with acidity; *sick headache; diarrhœa; cholera infantum*, etc. In cases of *sick headache*, due to gastric acidity or derangement, and which are ushered in with blurred vision, photopsia, and finally nausea and intense headache, I have found a drachm of charcoal mixed in a little syrup, to which is then added about a gill of water, and 10 or 12 drops of ether, to afford prompt relief; in very obstinate cases, the dose may require to be repeated 2 or 3 times, every 20 or 30 minutes (J. King). In some cases charcoal may be advantageously combined with the subnitrate of bismuth as a sedative; and where a laxative action is required, rhubarb may be beneficially added to it. *Bilious colic* is said to have been cured by it, in doses of 1 drachm in 2 fluid ounces of burnt brandy, repeated as required. Externally, it may be used in poultices to correct fetor of *ulcers*, arrest *gangrene*, etc., and is efficient in many *cutaneous diseases.* It absorbs foul gases generated in vaults, sewers, etc. It is also a useful hemostatic, having arrested *epistaxis* when subsulphate of iron had failed. "The *specific* use of charcoal," says Dr. Scudder (*Spec. Medication*) "is to arrest *hemorrhage from the bowels.* It has been used in enema, ʒss to ʒj, finely powdered, to 4 ounces of water, thrown up the rectum. Why this checks it I can not tell; that it does it, I have the evidence of my own eyes. For several years I have employed the second decimal trituration as a remedy for *passive hemorrhage*, with most marked benefit. I employ it in threatened hemorrhage during *typhoid fever;* in *menorrhagia*, especially when chronic; in *prolonged menstruation;* the watery discharge that sometimes follows menstruation; *hemorrhage from the kidneys; hemorrhage from the lungs;* and in some cases of *leucocythemia.* A good indication for this remedy is a small, pallid tongue with lenticular spots, and with this it may be given in any form of disease." It occasionally enters into tooth-powders, and may be used with advantage to correct the fetor of the mouth, and cleanse the teeth. In such cases, the charcoal prepared from bread is the best, as it contains no gritty particles. Water may be purified by passing it through charcoal mixed with sand. The ordinary dose of charcoal is from 20 grains to 2 drachms, 2 or 3 times a day, in water, milk, or burnt brandy, repeating it according to indications. For specific uses the 1 x, or 2 x trituration, 5 to 10 grains, as often as necessary.

Specific Indications and Uses.—A pallid, expressionless tongue, with slight coat and lenticular spots, or slight coat lifting in patches; pallid skin; feeble pulse; tumid, doughy abdomen; tendency to hemorrhage; frequent, foul, hemorrhagic bowel discharges; passive hematuria; passive hemoptysis; salty taste in the mouth. The remedy for asthenic hemorrhage and profuse secretion.

Carbon and Its Modifications and Related Products.—CARBON. Symbol: C. Atomic Weight: 11.97. A quadrivalent, sometimes bivalent, element, widely diffused over the earth. It is found in the earth as free carbon, especially as *graphite* (plumbago), and in crystallized, transparent condition, as *diamond.* In an impure amorphous form it exists as *coal.* It combines with oxygen to produce carbonic anhydride (CO_2), or carbon dioxide, existing in this form in considerable quantity in the atmosphere, and in effervescing mineral waters. In mineral formations it exists combined with other substances, forming carbonates. It is found very extensively in organic matter, both animate and inanimate; in fact, the study of so-called organic chemistry may be said to be the study of carbon and its compounds and derivatives. The black residue left when organic matter is heated, with limited access of air, is produced by freeing the carbon, or the process of carbonization, as it is called. Carbon occurs in 3 allotropic forms, viz.: Diamond, graphite, and amorphous carbon.

I. DIAMOND, one of the hardest bodies known, is a crystallized carbon. Electricity is not conducted by it. If heated, excluded from the air, it remains unaltered at very high temperatures, but if heated in the air or to whiteness in oxygen, combustion ensues, with the production of carbon dioxide. The diamond is the purest form of carbon. Its density is 3.5. It is found chiefly in India, Borneo, Brazil, and South Africa, while some diamonds have been unearthed in North Carolina and Georgia. An impure carbon-mass, containing both oxygen and hydrogen, and known as *anthracite diamond*, or *black diamond*, is said to be even harder than the true diamond.

II. GRAPHITE. *Plumbago*, or *Black lead.*—This next purest form of carbon presents a totally different aspect from the diamond. It is found abundantly in some localities, especially in England, and in New York, Massachusetts, and Canada. The purest form is said to come from the Borrowdale mines in England. In granite and other mineral formations it occurs sometimes in large lumps. It is crystalline, forming plates, which are hexagonal, soft, unctuous to the feel, usually of a dull-gray, or grayish-black color, and has a density ranging from 1.9 to 2.25. Graphite is infusible, and is a good conductor of the electric current. It is largely employed in the arts in the making of lead-pencils, crucibles, stove-polish, etc. The name *black lead* should be discarded, as graphite has no connection chemically, or otherwise, with lead.

III. AMORPHOUS CARBON.—This form of carbon is well known as *coal.* The purest variety is known as *anthracite*, or *hard coal.* The next variety is known as *bituminous*, or *soft coal*, a form containing considerable hydrogen. When subjected to red heat in closed retorts, volatile hydrocarbons and tar are given off, leaving *coke* as a residue. Coke is a fairly pure carbon, intermixed with the mineral components of coal. Anthracite coal contains about 90 per cent of carbon; bituminous coal, about from 75 to 90 per cent; and amorphous carbon (*lignite*), about 65 per cent. *Lampblack*, another amorphous carbon, is the result of the imperfect combustion of resinous, fatty and waxy material, the *smoke* so produced condensing as finely divided carbon, or *lampblack.*

FULIGO LIGNI. *Soot*, *Wood soot* (*Fuligo splendens*).—The best soot for medicinal purposes is that which is gathered within an air-tight wood stove and its pipe; that which is collected from a clean chimney or ordinary stove-pipe, where hard wood alone is burned, will ordinarily answer, if it be free from ashes and calcium compounds. Soot has a peculiar odor, somewhat resembling that of creasote, and a nauseously empyreumatic, more or less bitter and acrid, saline taste. Its infusion in water is of a dark-brown color, with the characteristic odor and taste of soot. It is a complex mixture of distilled products from the imperfectly burnt wood, ashes, or other fixed matters, carried up the chimney by the current of air. It consists of an empyreumatic resin (*pyretin*), combined with *acetic acid*, which also saturates the bases, calcium, potassium, and magnesium, of the ashes carried up the chimney. Acetate of ammonium, chloride of calcium, sulphate of calcium, extractive matter, creasote, carbon, silica, sesquioxide of iron, and nitric acid, have all been found in soot. The solution of soot, evaporated, furnishes a dark-colored extract, which, on being re-dissolved in water, forms a dark-brown solution. About 0.44 of soot is insoluble. It probably owes its virtues largely to creasote. Soot has deodorant and disinfectant properties, and may be employed in vaults, etc., to overcome foul effluvia.

Internally, soot was formerly much employed, and found valuable in all forms of disease attended with *acidity of the stomach*. A powder, composed of 1 part each of powdered rhubarb and soot, and half a part of bicarbonate of potassium, will be found invaluable in all such cases, removing acidity and a tendency to constipation. It may be given in doses varying from 3 to 12 grains, 3 times a day, or in sufficient quantity to cause 1 or 2 evacuations from the bowels daily. An infusion of soot, made so as not to be unpalatable, is very beneficial in *inflammation of mucous membranes*, and in *hysteria*. A strong decoction of soot, used as an injection into the rectum, has caused the expulsion of *ascarides;* its use should be continued for several days in succession; injected into the bladder it has been of service in *chronic inflammation of the bladder;* it should be injected twice a day for some days. It possesses no antispasmodic virtues, further than neutralizing the acidity of the stomach, to which the spasmodic action is owing. Combined with extract of geranium, in the proportion of 2 parts to 1 of the astringent, it will prove valuable in *diarrhœa* and *cholera morbus of children;* in *summer-complaint*, 1 part of the dried extract of leptandra, and ¼ part of camphor or ginger may be added to the above. The infusion or decoction may be made by adding 1 or 2 ounces of soot to a pint of water, macerate or boil for ½ hour, and filter. Dose, 1 or 2 fluid ounces, 2 or 3 times a day.

Externally, Prof. King used the *Unguentum Fuliginis* in cases of recent and extensive *burns*, with almost immediate relief. It must be spread on raw cotton and applied over the part. The ointment is also efficient in various *cutaneous disorders*, especially those of an *erysipelatous character*, *tinea*, *fistula*, *cancerous* and *syphilitic ulcers*, *pruritis vulvæ*, *specks on the cornea*, *scrofulous ophthalmia*, severe *burns* and *scalds*, etc. In some of these diseases the decoction will answer. In many ophtbalmic diseases, a strong decoction of equal parts of soot and hydrastis, will be found valuable. It may also be employed internally by mouth, or injection into the bladder or vagina, for *chronic mucous inflammation*. Soot is but little used at the present day.

FULIGOKALI.—A preparation called *Fuligokali* has been recommended in *scrofula*, *chronic rheumatism*, *rheumatic tumors*, and certain *herpetic affections*. It is made thus: To 2 or 3 parts of water add 50 parts of good, shining powdered soot, and 10 parts of caustic potash; boil the mixture for 1 hour, then dilute it when cold, and filter. The filtrate, when evaporated to dryness, yields a black powder, having a slightly alkaline taste, a burnt-like odor, and a ready solubility in water. It may be given 4 or 5 times a day, in doses of 2 to 3 grains. This substance should be kept in well-closed bottles (Deschamps). A stimulating discutient external application is made by triturating ½ ounce of prepared lard with 8 or 16 grains of fuligokali (Gibert).

ANTHRAKOKALI.—A preparation occurring as a black powder, produced by boiling porphyrized coal with a strong solution of caustic potash, in an iron vessel. The mass is stirred, while cooling, until a powder results. This forms *simple anthrakokali*, but when sulphur in small amounts is added to the coal before it is put into the boiling potash solution, the resultant product is *sulphurretted anthrakokali*. These preparations were introduced by Dr. Polya, who applied them externally, and also administered them in doses of 1 to 1½ grains, disguised in licorice-root powder. *Chronic rheumatic complaints*, including *rheumatic arthritic swellings*, as well as *scrofula*, and *skin diseases* of an herpetic character, were treated with it. An ointment (16 grains to 1 ounce of lard) was employed locally twice a day.

CARBONEI DISULPHIDUM (U. S. P.)—CARBON DISULPHIDE.

FORMULA: CS_2. MOLECULAR WEIGHT: 75.93.

SYNONYMS: *Disulphide of carbon*, *Bisulphide of carbon*, *Carbonei bisulphidum* (*U. S. P.*, 1880), *Alcohol sulfuris*.

Preparation and History.—Carbon forms two compounds with sulphur, a disulphide and a monosulphide; the former alone is of use in medicine or the arts. The latter is a more recent discovery, and is obtained by exposing the disulphide in sealed tubes to the sun's rays for several months (see Watts' *Dictionary*, 1888). Lampadius, in 1796, discovered carbon disulphide accidentally, while heating iron pyrites with charcoal, and, in 1802, Clement and Desormes obtained it by heating charcoal and sulphur. It is prepared upon a large scale by passing the vapor of sulphur over red-hot charcoal, in which case an impure carbon disulphide distills, and is collected in a cooled receiver beneath water. This crude article is always impure, containing dissolved sulphur and several sulphur compounds, which impart an offensive odor to the commercial article.

Purification.—Formerly, it was purified by repeated distillations from oil or fat, but, at present, the impure carbon disulphide is at first agitated with mercury until it ceases to blacken the bright surface of the metal, and then it is distilled from white wax; or it is allowed to remain a long time in contact with corrosive sublimate, or litharge, with frequent agitation, and is then distilled from bleached wax. M. Yvon, of Alfort, proposed the addition of copper turnings to the disulphide, in order to deodorize it, stating that it is not necessary to agitate it; the disulphide soon loses its offensive odor, and gives out an ethereal odor, free from all unpleasantness.

Description.—The *U. S. P.* describes carbon disulphide as follows: "Carbon disulphide should be kept in well-stoppered bottles, or in tin cans, in a cool place, remote from lights or fire. A clear, colorless, highly refractive liquid, very diffusive, having a strong, characteristic, but not fetid odor, and a sharp, aromatic taste. Soluble in 335 parts of water at 15° C. (59° F.); very soluble in alcohol, ether, chloroform, fixed and volatile oils. Specific gravity, 1.268 to 1.269 at 15° C. (59° F.). Carbon disulphide vaporizes rapidly at the ordinary temperature, is highly inflammable, boils at 46° to 47° C. (114.8° to 116.6° F.), and, when ignited, burns with a blue flame, producing carbon and sulphur dioxide. It should not affect the color of blue litmus paper moistened with water (absence of sulphur dioxide. A portion evaporated spontaneously in a glass vessel should leave no residue (absence of dissolved sulphur). Lead acetate T.S. agitated with it should not be blackened (absence of hydrogen sulphide)"—(*U. S. P.*). Its flashing point is stated differently by different authorities: 149° C. (300.2° F.), Frankland; 170° C. (338° F.), Braun; 160° C. (320° F.), Wagner's *Handbuch*, 1889. Its vapor, mixed with nitric oxide, burns with a bright-blue flame which is rich in actinic rays; and when mixed with oxygen or atmospheric air, the mixture explodes with great violence when inflamed. It evaporates so rapidly in the open air as to condense and congeal the moisture contained in the air on its surface; when evaporated in vacuo, a cold of —60° C. (—76° F.), may be obtained. It freely dissolves such bodies as essential oils, sulphur, phosphorus, iodine, bromine, camphor, gutta percha, caoutchouc, fats, wax, etc., and substances that are usually soluble in ether. It is insoluble in water, but soluble in alcohol, ether, and fats; its alcoholic solution becomes very readily changed, but if some essential oil of mint be added to it, it prevents its decomposition, and lessens any unpleasant odor. Under the action of the solar rays it assumes a yellow color. It is poisonous, and its vapor destroys small animals exposed to its action. When inhaled for some time, even in very small amount, it produces serious effects upon the nervous system. According to Zoller, meat may be preserved in an atmosphere which contains its vapor. It is used largely in various branches of the arts, as in india-rubber and woolen factories. Carbon disulphide has been employed in the process of the extraction of alkaloids to eliminate the fats, resins, chlorophyll, etc., present; to extract croton oil, bay oil, butter of cocoa, butter of nutmegs, oil of male-fern, oil of spruce, fir, etc.; to extract the fat from wool, bones, etc.; to manufacture soluble spices; to purify paraffin; to destroy certain noxious insects and animals; to preserve meats, fruits, etc.; also used to extract sulphur from certain minerals. It forms no solution with water, and advantage has been taken of this fact to determine the amount of moisture in commercial iodine. Berzelius found that it unites with metallic sulphides to form salts called *thiocarbonates* or *sulphocarbonates*, in reality the salts of *thiocarbonic acid* (H_2CS_3), which is analogous to carbonic acid, the oxygen of which merely is replaced by sulphur. Carbon disulphide combines with *triethylphosphine* ($P[C_2H_5]_3$) to form a solid which crystallizes in beautiful red crystals ($P[C_2H_5]_3CS_2$). The formation of these crystals serves as a sensitive test for carbon disulphide. Another test not quite as sensitive consists in the formation of potassium xanthate by the combination of carbon disulphide with alcoholic potassa solution. Carbon disulphide, for medicinal use, should not possess a repulsive odor; the fetor of the commercial article, as we have said, is owing to its impurity. It should likewise be neutral to litmus paper, and should not blacken mercury, nor precipitate a solution of plumbic acetate when agitated with it (Hoffman). As frequent contact with air occasions its deterioration, carbon disulphide, for medicinal use, should be placed in small, well-stoppered bottles, and kept in a cool place; it should not be handled nor poured out in the vicinity of flame.

Action, Medical Uses, and Dosage.—Disulphide of carbon was first used as an anæsthetic, in 1848, by M. Harald Taulow, of Christiania, Norway. Subsequently, Dr. Simpson, of Edinburg, confirmed the fact of its anæsthetic properties, and published his experiments to the profession (*Pharm. Jour.*, VII, p. 517). Its unpleasant odor, the disagreeable symptoms following its inhalation, as frequent pulsations, headache, vertigo, emesis, and annoying visions, together with its brief anæsthetic influence, have proved objections to its coming into general use. Inhalation of air saturated with the vapor of the disulphide has been found injurious, as observed in the manufactories where it is employed for dissolving caoutchouc. The symptoms resulting from such inhalation have been described, by those physicians who have investigated this point, as follows: Headache, vertigo, wakefulness, impairment of the mental faculties, over-excitement of the nerves, neuralgic pains, cramps, bluntness of the senses of touch, sight, and hearing, impotency, derangements of the digestive functions, dyspnœa, palpitation, debility, emaciation, and occasionally, delirium. The period of excitation will be manifested in various ways, by vehement laughter, boisterous talking, rambling singing, weeping, etc. Mansfield, Wurtz, and others, have advised its internal use, in doses of 2 drops in milk, or in sweetened water, repeated every 2 hours, as an emmenagogue; it has also been proposed as a stimulant and sudorific in *rheumatic* and *gouty affections*, and in certain *cutaneous maladies*, but the uncertainty of its effects, and the serious symptoms apt to follow the ingestion of even a few drops, as intense burning sensation in the mouth and fauces, sickness at stomach, emesis, gastralgia, flatulency, and difficult micturition, will undoubtedly prevent its general use as an internal therapeutic agent. Dr. J. T. Whittaker has reported to have found its internal administration of considerable efficacy in the treatment of *carcinoma*, and especially that of the stomach; he administered it in doses of 2 drops in alcohol or almond oil, repeated every 2 or 4 hours. Although not curing the disease, it promptly mitigated the severe symptoms, improved the health and strength, and prolonged the life of his patients.

Its application, externally, has been found of great value in certain diseases. Its vapor, directed through a tube upon the eye, or upon the outer surface of the drum-membrane, for a few seconds, or until a glow of heat is experienced, acts as a stimulant and promotes absorption in the parts; employed in this manner, it has proven efficient in *deafness* due to deficient nerve power, lack of cerumen, in purulent discharges from the meatus auditorius, in tinnitus due to indurated cerumen with dryness of the canal, and in *eczema* of the ear; also in *chronic inflammation of the conjunctiva*, *ulceration of the cornea*, *lachrymal suppression*, *muscæ*, *sclerotitis*, and in *scrofulous ophthalmia*, *phlyctenular formations*, etc. In *rheumatism*, *lumbago*, and other painful affections, benefit will often follow the application of the disulphide, on cotton or on a compress, over the painful parts; it should be allowed to remain in contact until a smarting sensation is produced. When it occasions pain, as will sometimes be the case, the vapor may be directed upon the part, instead, and be continued until the smarting sensation is complained of. If the disulphide be sprayed upon the part, allowing it to evaporate from time to time, before a renewal of the spray, in a few minutes local anæsthesia will result, pain will be relieved, and, if necessary, deep incisions may be made without any pain being felt. In this manner, it will likewise frequently be found useful in *goitre*, *lupoid growths*, *glandular enlargements*, and *indolent tumors*. In many of the maladies just referred to, the efficacy of the remedy may be increased by the addition of iodine to the disulphide. Under the local anæsthesia that may be produced with the spray of carbon disulphide, such minor operations as the *evulsion of nails*, *opening of abscesses*, etc., may be painlessly performed. Topically applied it is also reputed a good remedy for various forms of *neuralgia*, particularly that associated with *locomotor ataxia* (applied upon the spine), and in neuralgic forms of *headache*, and in *toothache*.

In *atonic wounds* and *chronic ulcers*, its local application has proven very beneficial, as well as in *ulcerations* of a scrofulous or syphilitic character. A camel's hair pencil, or a pledget of lint, moistened with the fluid, is quickly and lightly passed over the surface of the wound or ulcer, which may then, if necessary, be immediately covered with a layer of finely pulverized subnitrate of bismuth or starch. This may be repeated once every 1, 2, or 3 days, according to the degree of inactivity of the ulcer. Its application is followed by intense pain, which, however, does not last longer than from 20 seconds to 3 or 4 minutes. Applied to *ulcers of the cervix uteri*, the pain continues but a few minutes, while that produced by other agents, as, for instance, acid nitrate of mercury, frequently continues for many hours. The pain gradually becomes less and less with each application, and as the cicatrizing process becomes confirmed, it diminishes and disappears. Dr. Dorring considers it by far the best local application known, for *indolent ulcers*. This fluid has also been applied in the form of a liniment, composed of 1 part of the disulphide to 4 parts of olive oil; also an ointment in *parasitic cutaneous diseases*, consisting of 1 part of the disulphide to 4 or 8 parts of lard. These should be kept in well-closed vessels.

Insects, frogs, lizards, dissected or not, and parts of animals, suspended from hooks, or deposited upon perforated shelves, may be preserved indefinitely in a perfectly air-tight vessel containing 5 drops of disulphide of carbon for every quart of air capacity. Strawberries, raspberries, cherries, beans, currants, cucumbers, peaches, radishes, etc., may be completely preserved in the same way, the only change noticeable being a fading of the color, and an exudation of juice from the berries. A short exposure to the air on removing these articles from the vessel, will render them fit to eat, and with a flavor the same as when fresh. The preservative powers of this fluid are chiefly due to its coagulation of albuminoids, and its lessening the quantity of free water in the article preserved in it. Seldom used internally. Dose, ½ to 2 drops in alcohol, almond oil, milk, or sweetened or mint water.

CARBONEI TETRACHLORIDUM.—CARBON TETRACHLORIDE.

FORMULA: CCl_4. MOLECULAR WEIGHT: 153.45.

SYNONYMS: *Carbonii tetrachloridum, Tetrachlor-methane, Carboneum chloratum, Chlorocarbon.*

History and Preparation.—Regnault discovered chlorocarbon, in 1839, but it did not become prominent until Simpson, of Edinburgh, suggested its use as an anæsthetic, in 1865. To prepare it, dried chlorine gas is made to pass through disulphide of carbon, then through a copper-wrapped tube of porcelain, filled with fragments of porcelain and maintained at a red heat, whereby a reaction ensues, in which sulphur chloride and carbon tetrachloride are produced, thus: $3Cl_2+CS_2=S_2Cl_2+CCl_4$. Then, by the aid of ice, or other means of refrigeration, the vapors are condensed to a yellow-red liquid, treated to an excess of solution of caustic potash, or milk of lime, added slowly to decompose and dissolve the sulphur chloride. The chlorocarbon sinks to the bottom, and is distilled to effect its purification. It is also produced when chloroform, or marsh gas (CH_4), are acted upon by chlorine in direct sunlight, the result being chlorocarbon and hydrochloric acid.

Description.—Chlorocarbon (CCl_4) is a chlorinated derivative of methane or marsh gas. It is sometimes alluded to under the old name, bichloride of carbon, given it under the old chemical notation. It is a thin, colorless, oily fluid, of an agreeably fragrant odor, soluble in ether and alcohol, but not in water. Its density is 1.599; its boiling point 77° C. (170.6° F.). If carbon disulphide be present it may be removed by solution of caustic potash, which does not decompose the chlorocarbon at ordinary temperature.

Action and Medical Uses.—This agent is pleasant in odor, and, when inhaled, first produces a cooling sensation in the fauces, followed by a general glow of warmth throughout the body. If its administration be stopped short of anæsthesia, a prolonged sense of calm is experienced, followed by a refreshing sleep. Anæsthesia is quickly produced by it, but complete consciousness returns very shortly after ceasing inhalation. It was experimented with by Drs. Sansom and Harley, in 1864, and introduced into general medicine, as an efficient anæsthetic, by Simpson, of Edinburgh, in 1865. Owing to its depressing action upon the heart, it has been practically discarded, being considered a dangerous agent, even when skillfully handled.

Related Compound.—CARBON TRICHLORIDE, or *Hexachlorethane* (C_2Cl_6). When in direct sunlight dry chlorine gas is made to pass into either ethydene chloride ($C_2H_4Cl_2$), or ethyl chloride (C_2H_5Cl), until the fluid solidifies, a crystalline mass of carbon trichloride forms, which may be purified by recrystallizing with alcohol. It forms in white or colorless prisms of the rhombic system, is almost tasteless, has an aromatic and camphor-like odor, and is brittle and easily reduced to a powder. Alcohol, fats, essential oils, and ether easily dissolve it, but it is not soluble in water. Its density is 2.0. At the temperature of the air it slowly volatilizes; at 160° C. (320° F.) it fuses; and at 182° C. (359.6° F.) it forms a crystalline sublimate. Burned with alcohol it exhibits a red flame.

CARDAMOMUM (U. S. P.)—CARDAMOM.

"The fruit of *Elettaria repens* (Sonnerat), Baillon"—(*U. S. P.*). (*Elettaria Cardamomum*, Maton; *Alpinia Cardamomum*, Roxburgh; *Amomum repens*, Sonnerat; *Amomum Cardamomum*, White; *Renealmia Cardamomum*, Roscoe; *Matonia Cardamomum*, Smith).

Nat. Ord.—Scitamineæ.

COMMON NAMES AND SYNONYMS: *Cardamom seeds, Malabar cardamoms; Cardamomum Malabaricum, Cardamomum minus.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 267.

Botanical Source.—*Elettaria repens* has a knobbed, perennial rhizome, with many fleshy radicles. The stems are numerous, erect, simple, jointed, enveloped in the spongy sheaths of the leaves, and about 4 or 6 feet high. The leaves are bifarious, subsessile on their sheaths, lanceolate, fine-pointed, somewhat villous above, sericeous underneath, entire, 1 or 2 feet long, and nearly $\frac{1}{2}$ foot broad: the sheaths are slightly villous, with a rounded ligula rising above the mouth. There are from 3 to 5 scapes proceeding from the base of the stem, which are from 1 to 2 feet long, lying upon the ground, flexuous and jointed; the branches or racemes are alternate, 1 from each joint of the scape, sub-erect, and 2 or 3 inches long. The solitary bracts are oblong, smooth, membranous, striated, sheathing, and but 1 at each joint of the scape. The flowers are alternate, short-stalked, solitary at each joint of the racemes, opening in succession as the racemes lengthen. The calyx is monophyllous, funnel-shaped, 3-toothed at the mouth, about $\frac{3}{4}$ of an inch long, striated with fine veins, and permanent. The tube of the corolla is slender, as long as the calyx; limb double, exterior of 3 oblong, concave, nearly equal, pale, greenish-white divisions; inner lip obovate, much longer than the exterior divisions, somewhat curled at the edge, with the apex slightly 3-lobed, and marked chiefly in the center with purple-violet stripes. Filament short and erect; anther double and emarginate. Ovary oval and smooth. Style slender. Stigma funnel-shaped. Capsule oval, somewhat 3-sided, size of a small nutmeg, 3-celled, and 3-valved; seeds pale-brown, coriaceous, and numerous (L.).

History and Description.—Elettaria repens inhabits the mountainous parts of the coast of Malabar, where it grows both cultivated and uncultivated, the cultivated plants generally yielding the commercial cardamoms. (For account of culture, see *Pharmacographia*). The fruit, which is the official part, is not obtained until the shrub has reached its utmost height, which requires 4 years. The Pharmacopœia describes cardamoms as "ovoid or oblong, from 10 to 15 Mm. ($\frac{2}{5}$ to $\frac{4}{5}$ inch) long, obtusely triangular, rounded at the base, beaked, longitudinally striate; of a pale-buff color, 3-celled, with a thin, leathery, nearly tasteless pericarp, and a central placenta. The seeds are about 4 Mm. ($\frac{1}{5}$ inch) long, reddish-brown, angular, rugose, depressed at the hilum, surrounded by a thin, membranous arillus, and have an agreeable odor and a pungent, aromatic taste"—(*U. S. P.*). They contain about 75 per cent of the seeds which contain the active properties, while their covering, which has very little smell or taste, should be rejected; the aromatic, camphoraceous flavor of the seeds is soon lost when deprived of the capsules covering them.

The length of the commercial cardamoms varies, and on this account dealers have denominated, *longs, mediums* (*short-longs*), and *shorts*. The *Malabar*, as well as *Aleppi* fruits, constitute the ovoid varieties, while the longer and more acuminate seeds are the *Madras cardamoms*.

Chemical Composition.—Water or alcohol takes up the virtues of the seeds, which Trommsdorff found, in 1834, to be due to a colorless, strongly fragrant, volatile oil, of sp. gr. 0.943, which is very soluble in alcohol, ether, oils, and acetic acid; insoluble in potash-lye. It has a hot, camphoraceous, bitter taste, and exists to the extent of 5 per cent and less in Malabar cardamoms (Flückiger, 1891). By keeping, it becomes yellow, viscid, and loses its peculiar taste and smell. It consists chiefly of terpene bodies, whose constitution is $C_{10}H_{16}$. Crystalline *terpin hydrate* ($C_{10}H_{16}.[H_2O]_3$) was obtained by Dumas and Péligot from oil that had been kept for a considerable length of time. The seeds contain also about 10 per cent of fatty oil, and the ash contains a marked amount of manganese, some starch, gum-like extractive, coloring material, and potassium salts—(*Pharmacographia*).

Action, Medical Uses, and Dosage.—Cardamom seeds are very warm, grateful, pungent and aromatic, and form an agreeable addition to bitter infusions, and other medicinal compounds. They are chiefly employed as a carminative in *flatulency*, and to flavor syrups, tinctures, etc. Dose of the powder, from 10 grains to 2 drachms; infusion (bruised seeds, ℥j to boiling water, Oss), a wineglassful. As the powder rapidly loses its aromatic property, the seeds should be pulverized from time to time, as they are required for present employment.

Other Cardamoms and Related Seeds.—The following cardamoms are used in Oriental countries, but are not often seen in American commerce:

I. Ceylon Cardamom.—This variety is variously known as *Long, large*, and *wild cardamom*. In the East it is incorrectly termed *Grains of Paradise*. It is the product of a Ceylon plant, the *Elettaria major*, Smith, now regarded merely as a variety of *Elettaria repens*. The fruits are from 1 to 2 inches long, lance-oblong, have 3 flat sides, are sometimes arched, and of a deep gray-brown color. They are terminated with a prolonged apex. They contain more seeds than the Malabar cardamom, and are larger, and differ in taste and odor, being less agreeable. Its properties are similar to those of cardamom, having essentially the same chemical components, besides, according to Flückiger, a dextrogyrate body, apparently like ordinary camphor.

II. Round Cardamom.—Known also as *Cluster cardamoms*. This variety is the fruit of *Amomum Cardamomum*, Linné, growing in the East Indies and in Siam. They grow in compact clusters, are globular or ovate, about the size of a common cherry, and have a somewhat hairy, buff-colored pericarp. The seeds resemble those of Malabar cardamom, but have a more strongly aromatic, camphoraceous taste. They are consumed considerably in South Europe.

III. Xanthioid Cardamom.—This is the fruit of *Amomum xanthioides*, Wallich, growing in Siam and Tennasserim, and is variously known in English markets as *Cardamom seeds, Bastard* or *Wild cardamom of Siam*. They have received their specific name from the fact that the pericarp is thickly covered with fleshy, spinous projections, as in the species of *Xanthium*. The seeds only appear in market, and resemble those of cardamom, being, perhaps, more finely wrinkled, but differ in flavor.

IV. Nepal Cardamom.—This corresponds almost exactly with the following variety, except that it terminates in a tube-like calyx, of at least the length of the fruit itself, and differs also in being sometimes borne on a short stalk (*Pharmacographia*). It is produced by an undetermined species of *Amomum*.

V. Bengal Cardamom.—This variety is known as *Morung elachi, Buro elachi*, and *Winged Bengal cardamom*. The fruit has a brown color, is about an inch in length, of ovoid or subobconic form, rounded at the lower end, and has 9 jagged, ridge-like wings near the distal extremity, the latter terminating in a truncated, nipple-like projection. It contains from 60 to 80 highly aromatic and camphoraceous seeds, imbedded in a viscid, sweet pulp. The wings are more readily seen if the seeds be soaked in water. Bengal cardamom is the fruit of *Amomum subulatum*, Roxburgh.

VI. Java Cardamom.—A Java plant, the *Amomum maximum*, Roxburgh, furnishes this variety. They are borne in a globe-like group, each scape having from 30 to 40 fruits. They are conical, or ovoid, stalked, 1½ inches in length, by 1 inch in breadth (when fresh), have 9 or 10 conspicuous wings passing the whole length of the fruit, and coarsely dentated, except in the lowermost portions. They are faintly aromatic, and their essential oil is of an inferior quality. They have an edible pulp which is prized by the Javanese.

VII. Korarima Cardamom.—*True cardamomum majus, Korarima, Heil, Guráji spice, Habhal-habashi, Heel habashee*. Conical, perforated fruits, resembling inverted figs, and having aromatic, angular seeds resembling in taste and odor those of Malabar cardamoms. They are perforated by the natives so that they may be strung to dry, and in this manner are occasionally used by the Arabs for rosaries. The plant which produces them inhabits eastern Africa, and has not been described by botanists, but Pereira proposed for it the name *Amomum Korarima*.

VIII. Chinese Cardamom, or *Round Chinese cardamom*.—This is the fruit of the *Amomum globosum*, Loureiro, and is characterized chiefly by having a rounded side.

IX. Madagascar Cardamom.—This fruit is believed to be derived from the *Amomum angustifolium*, Sonnérat. It is ovate, striated, has one flattened side, is pointed, and presents at the base a broad scar, circular in outline, and surrounded by a raised, wrinkled, and notched border. The taste and flavor resemble those of the official variety.

Grana Paradisi.—*Grains of Paradise, Guinea grains, Melegueta pepper, Piper melagueta.* At least 7 species of fruits have at times received the name of *grains of Paradise*. That now recognized as the true variety is the fruit of *Amomum Melegueta*, Roscoe, a reed-like plant growing widely distributed along the tropical portions of western Africa. The botanical source of this plant has given rise to much confusion, but as Mr. Daniel Hanbury raised well-developed specimens (from the commercial seeds), which bloomed and bore the perfect fruit, the botanical origin above given seems clear from doubt. It is stated that there are two grades or varieties of seed in market, according to some authorities, both being the fruit of the same plant, while others believe one variety to be derived from *Amomum granum paradisi*, Afzelius, said to be a Sierra Leone plant. It is the smaller of the two kinds. The commercial *grains of Paradise* resemble cardamom seeds both in appearance and size, but do not possess a rugose surface. The seeds are variable in shape, but generally are $\frac{1}{10}$ inch in diameter, They are somewhat rounded, or blunt-angular, hard, shining, and of a red-brown color. The hilum is not so deeply colored, and that sort referred to as *melegueta pepper* or *Guinea grains*, has an elevated, tufted, beak-like hilum, while the smaller kinds present a broad, depressed hilum. Both are faintly aromatic in odor, but have a very hot, peppery taste. Under the name of "*grains*" they were used as pepper, and as an ingredient of a spiced wine—*hippocras*—containing also ginger and cinnamon, they were quite popular in the middle ages. Grains of Paradise contains a volatile oil having a fragrant, but non-acrid taste. It is neutral, yellowish in color, and possesses the agreeable odor of the seeds. It dissolves sparingly in alcohol, but is soluble in carbon disulphide. Iodine is dissolved by it. Its formula, according to Flückiger, is ($C_{20}H_{32}O$), and density 0.825 at 15.5° C. (60° F.). The ash is colored greenish through the manganese present. Gum, tannin, starch, and a viscid, brown resin, soluble in acetic acid, have also been obtained from the seeds. Thresh (1884) announced the discovery of the active constituent as a viscid, pale-yellow fluid, without odor, but having a pungent taste, not so peppery, however, as capsaicin. Grains of Paradise are employed almost wholly in giving fictitious strength to liquors, and in compounding certain veterinary powders.

CARDUUS MARIANUS.—ST. MARY'S THISTLE.

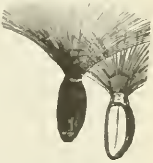
The ripe seeds of *Carduus marianus*, Linné (*Cnicus marianus*, *Silybum marianum*, Gærtner).

Nat. Ord.—Compositæ.

COMMON NAMES: *Mary thistle*, *Milk thistle*, *St. Mary's thistle*.

Botanical Source.—Mary thistle is an annual, or biennial plant, glabrous, or but slightly wooly, growing to a height of 2 or 3 feet, and branching but little. Its leaves, which are shining and smooth above, are marked with white veins; the lower leaves are deeply pinnatifid, the lobes being broad and very prickly; the upper ones clasp the stem by prickly auricles, and are scarcely decurrent. The large, drooping flower-heads, with purple florets, are solitary and terminal upon the branches. The involucral bracts are very broad at the base and have a stiff, spreading leaf-like appendage, terminating in a long spine, and bordered at its base with prickles. The fruit is an achenium. The pappus hairs are simple.

Fig. 57.



Carduus marianus.

History and Description.—Mary thistle is indigenous to southern Europe. The part used in medicine is the fruit known as *Fructus silybi*, or *Semen cardui mariæ*. The achenia are from $\frac{1}{6}$ to $\frac{1}{5}$ of an inch long, obovate, smooth, shining, and pale-brown in color, with striæ of a black, or blackish hue. At the apex they are oblique and have a marginal crown of a yellowish color, from the center of which the style-base projects. They have no odor, but a mucilaginous and oleaginous, as well as bitterish, taste. They yield their virtues to diluted alcohol. The Homœopathic mother tincture is prepared by covering the whole ripe seeds (1 part by weight) with diluted alcohol (2 parts), and letting stand in a dark, cool place in a well-stoppered bottle for 8 days, shaking twice a day. It is then decanted, strained, and filtered. The introduction of this medicine into Eclectic therapeutics is due chiefly to Prof. H. T. Webster, M. D. (*Dynam. Therap.*), and to Prof. Finley Ellingwood, M. D. (*Ecl. Annual*, Vol. I).

Action, Medical Uses, and Dosage.—Carduus marianus is an old remedy, which had nearly passed out of use and has more recently been revived. Rademacher valued the seeds in *hemorrhages* associated with *splenic* or *hepatic disorders*. That it influences the parts supplied by the cœliac axis, particularly the distribution of the hepatic and splenic arteries, especially the latter, seems well established. *Congestive conditions of the splenic circulation* are those most benefited by it. To a lesser extent, the whole venous apparatus is influenced by this drug, giving power to the veins, and preventing *varicoses* and other dilatations. But little effect, however, is observed upon the hemorrhoidal circulation, as piles do not seem to be directly benefited by it. Dull, aching, splenic pain passing up under the left scapula, and associated with pronounced general debility and despondency is the indication for its use. It controls splenic pain even where no enlargement can be detected, and it is the remedy for *hypertrophy of the spleen* when non-malarial in character. *Congestion of the liver, spleen* and *kidneys* is relieved by its use. *Bilious states*, with stitches in the side and pain in the abdomen, hard and tender right hypochondrium, *gall stones, jaundice, hepatic pain and swelling*, *vomiting of pregnancy*, and *leucocythemia*, are conditions in which it is reported useful. *Amenorrhœa*, with wrong of the portal circulation, *melæna*, *hemoptysis*, and *uterine hemorrhage*, have all been successfully treated with it. *Hematuria*, with weight and pain in the pelvis, has been promptly met by 25-drop doses in water, twice a day. *Painful dysuria*, from *urethral caruncle*, and *pelvic congestion* have also been quickly relieved by it. A strong tincture (seed, ℥viii to alcohol Oj), or the homœopathic mother tincture, in doses of from 1 to 20 drops.

Specific Indications and Uses.—Splenic, hepatic and renal congestion, face sallow, appetite capricious; nervous irritability; despondency; physical debility; pain in either hypochondriæ; pelvic tension and weight; congestion of the parts supplied by the cœliac axis; and non-malarial splenic hypertrophy.

CARICA PAPAYA.—PAPAW.

The juice of the fruit, and *Papain*, the digestive ferment, obtained from *Carica Papaya*, Linné (*Papaya vulgaris*, De Candolle).

Nat. Ord.—Passifloraceæ.

COMMON NAMES: *Papaw*, *Pawpaw*, *Mamæiro*.

ILLUSTRATIONS: *Botanical Register*, Plate 459; *Botanical Magazine*, 2898 and 2899.

Botanical Source.—Carica Papaya is a tree indigenous to South America, where it is met with in its wild condition, as well as under cultivation, and varies in height, according to its wild or cultivated state, from 5 to 30 feet, and is about 1 foot in diameter (Rees' *Cyclopædia*). The trunk or stem is simple, erect, without branches, and gradually tapers from the base to the summit, where it terminates in a cluster of leaves, after the manner of a palm. Its entire length is thickly covered with the scars of the fallen leaves. The leaves are large, alternate, close together, palmately divided into from 5 to 7 irregularly cut lobes, and are borne on leaf-stalks 1 or 2 feet in length, and which are peltately attached. The flowers are diœcious, rarely monœcious, and are grouped at the top of the trunk; the male flowers are borne on long peduncled racemes; the female flowers are solitary and axillary on short stalks, and consist of a small, 5-parted calyx, 5 twisted, pale-yellow petals and a large ovary, bearing 5 dilated, subsessile stigmas. The ovary is globular, 1-celled, and contains numerous ovules attached to 5 parietal placentæ. As the ovary enlarges and develops, the leaves gradually fall off, and the fruit, when matured, appears suspended to the highest part of the smooth trunk (L.).

History.—The Carica constitute a family of phanerogamous plants, which grow in the East Indies and in South America, either in a natural state or cultivated. The following species have properties similar to those of *C. Papaya: Carica spinosa*, Well, a native of the provinces of Pernambuco, Rio de Janeiro, etc.; and *Carica dodecaphylla*, or *jaracatia*, a tree of high stature, with a trunk furnished with spines. When incised, this last gives a milky juice. Its fruit is smaller and longer than that of the *Carica Papaya*.

The *Carica Papaya* is cultivated throughout the greater part of Brazil, and its fruit bears some resemblance to that of the Cucurbitaceæ, especially to the genus *Cucumis*. The fruit, when ripe, is yellow, irregularly ovoid, with 5 rib-like projections; it is pulpy, enclosing numerous blackish seeds, and has a rather agreeable, sweetish taste. The root is said to have an odor resembling that of rotten cabbage. In Brazil, the common name of the plant is *mamæiro*, and the fruit is called *mamao*. The juice or milk proceeding from the bark or fruit is the part that has attracted attention. In 1850, Hœferk stated that the juice was milky, bitter, and possessed the property of an irritant poison, and that, when mixed with water, it was used to soften tough meats, by macerating them in the liquid. A. Pinto, A. Camara, and Martius have made nearly the same statements; and Pinto also remarks that it is used to render the skin of the hands soft, and to remove freckles from the face. In 1875, Dr. Roy, an English physician, instituted some experiments with the milky juice, and found that it had the property of softening and dissolving meats; a microscopic examination of the meats thus dissolved showed a complete disintegration of the muscular fibers, the fasciculi being dissociated, and the ultimate fasciculi in a fair way for separation. The entire fluid mass was swarming with vibriones. Other investigators have arrived at the same results.

Chemical Composition.—The milk of *mamairo*, whether from the bark or from the fruit, is so small in amount that a sufficient supply for instituting a regular chemical analysis can not be procured; the greatest quantity that has been obtained from a large number of trees and fruit is in all about 1 fluid ounce. Another circumstance which antagonizes analysis and interferes with investigation of its physiological and therapeutical effects, is the extraordinary rapidity with which it enters into fermentation, and which commences a few seconds after its extraction. The seeds of the fruit contain a resinous acid, which is probably their active principle. Dr. T. Peckolt obtained it by treating the fresh seeds with boiling alcohol and hydrate of lime, and then separating it by means of hydrochloric acid. It forms a yellowish powder, possessing a pungent taste.

The active principle or ferment of *Carica Papaya*, a true vegetable pepsin, formerly termed *caricine*, is now known as *papain*, or *papayotin*. Mauriac obtained it (from the leaves) by extracting the juice from those recently gathered and filtering it. To the turbid and yellowish-green filtrate, double its volume of absolute alcohol was added, and, gradually, a flocculent precipitate of *papain* formed upon the filter, slightly greenish and amorphous. This may be purified by new solutions and precipitations, and then carefully drying at a temperature not to exceed 40° C. (104° F.). Papain is obtained from the leaves in the proportion of 4 parts to 100. It is insoluble in alcohol, and perfectly soluble in distilled water. Nitric and hydrochloric acids, bicarbonate of sodium, or of potassium, and caustic potash have no action upon it. It may be employed as a solvent of albuminoid materials in certain forms of dyspepsia, and as an anthelmintic.

Papain is an amorphous powder, white, or yellowish-white, practically odorless when pure, and has a feeble taste, almost imperceptible, yet faintly suggestive of pepsin. Its composition, further than the fact that it contains 10.6 per cent of nitrogen, has not yet been determined. It dissolves in water and glycerin, the aqueous solution becoming turbid when boiled. Its peptonizing powers are said to be greater than those of pepsin, 0.1 part being capable of dissolving from 100 to 200 parts of moist blood fibrin (see Wurtz, *Amer. Jour. Pharm.*, 1881). It acts under all conditions, whether in neutral, acid, or alkaline media, and is most energetic in the presence of a small amount of fluid. A considerable portion of the papain on the market is said to be practically inert.

In 1890, Dr. Greshoff, in Batavia (Java), discovered a new alkaloid in the leaves of Carica Papaya, which he named *carpaine*. It exists to the extent of 0.25 per cent in the dried and young leaves, but only in an amount of 0.07 per cent in old leaves; has a bitter taste, and a melting point of 121° C. (249.8° F.). The formula is $C_{14}H_{25}NO_2$, and its physiological properties were investigated by Dr. von Oefele, who found that, with the exception of the caffeine group, carpaine was the only digitalis substitute which, by subcutaneous injection, did not cause local irritation or abscesses, while internal doses of 0.025 Gm. per day did not show any advantage over digitalis (*Amer. Jour. Pharm.*, 1893).

Action, Medical Uses, and Dosage.—Without entering into a description of the varied experiments that have been made with the milk of carica, and concerning which an excellent account is given by Dr. Moncorvo, of Rio de Janeiro, in his translation of an article in the Portuguese language, entitled: "Note on the Physiological and Therapeutical Action of *Carica Papaya*," by Dr. E. Mauriac, we will simply refer to the conclusions drawn therefrom. This substance exerts a real dissolving or digestive action upon nitrogenized substances; this action is likewise obtained with it in aqueous solution, while its solution in alcohol appears to render it wholly inert. It has no action upon feculent substances. Applied upon the skin, it renders it softer and more smooth, and appears to destroy the projections formed at certain points by a greater or less thickening of the epidermis. Upon the skin deprived of its epidermis, and upon the subcutaneous cellular tissues, it has an extremely irritating action, provoking intense inflammation; and, in addition, the formation of abscesses, rapidly followed by a putrid infection when 30 grains were hypodermatically injected, these symptoms being preceded by severe pain, moaning, and great difficulty of motion. Upon the digestive mucous membrane it acts as a caustic and corrosive substance, its effects being rapid, violent, deep-seated, and occasioning energetic purgation. According to Desjardins, boiling removes these corrosive effects, and it then proves the most active vermifuge of the Materia Medica, in doses of 1 or 2 drachms, mixed with an equal quantity of castor-oil, a single dose being sufficient to cause the expulsion of an astonishing number of the *lumbricoids.* The seeds possess an identical property, and will probably be found preferable for administration. It is likewise said to cause the destruction and expulsion of the *tapeworm.* Various preparations of carica are reputed abortifacient and galactagogue.

The chief property of the milk of the carica is its action upon food, similar to that of pepsin, exercising, like this latter article, a digestive influence upon albuminoid substances. But the difficulty of procuring and preserving a sufficient amount of it for therapeutical use, together with its deeply irritating action, will prevent it from coming into use as a remedy for *dyspepsia* or *gastric affections.* To overcome these obstacles, Dr. Mauriac instituted a series of experiments with the leaves of the tree, and found that a concentrated decoction of them exerted upon albuminoid substances an action analogous to that of the milky juice of the tree and of the green fruit, without any appreciable irritation of the gastric mucous membrane. This decoction must be administered in small doses. Dr. Mauriac and others, however, prefer papain, the action of which does not appear to be interfered with by an acid or neutral condition of the stomach, and which, being more energetic than pepsin, must be given in smaller doses, and in aqueous solution. Papain has been used in *atonic* and *fermentative dyspepsia*, with painful acid eructations, flatulence, and constipation.

The softening and disintegrating qualities of papain (generally in alkaline combination, as with borax or potassium carbonate), have been taken advantage of in the treatment of *warts, corns, sinuses,* and *chronic forms of scaly eczema, cutaneous tubercles,* and other *hardness of the skin,* produced by irritation, etc., and injected into *indolent glandular tumors* to promote their absorption. *Epithelioma* has been similarly treated, but this painful procedure is not to be commended. *Glossal fissures* and *ulcerations,* and particularly *syphilitic ulcerations* of the throat, mouth, and tongue, are asserted to have yielded to alkaline solutions of papain. Papain, in 5 per cent solution, when pure, is credited with the power to dissolve the false membranes of *diphtheria* and *membranous croup.* This can be accomplished only when the solution can be brought into contact with the membrane by means of a brush or spray. It must be frequently applied as it has no power to prevent a subsequent formation of the membranous exudate. A 5 per cent solution of papain, with sodium bicarbonate, 5 grains, warmed and instilled into the ear in quantities of 10 or 15 drops, and allowed to remain 1 hour, has given good results in *chronic suppurative inflammation of the middle ear,* with scanty, offensive discharge; the 5 per cent solution alone has been employed to remove *hardened secretions* from the auditory canal. The dose of papain is from 1 to 5 grains.

CAROTA.—WILD CARROT.

The root and fruit of *Daucus Carota,* Linné.

Nat. Ord.—Umbelliferæ.

COMMON NAME: *Wild carrot.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants,* 135.

Botanical Source.—Wild carrot is a biennial herb, with a slender, yellowish, aromatic, spindle-shaped and sweetish root. Its stems are 2 or 3 feet high, round, branched, erect, furrowed, leafy, hairy, or bristly. The leaves are alternate, on broad, concave, ribbed footstalks, bipinnate, cut, narrow, acute, and distantly hairy; the leaflets are linear and acute. The flowers are small, white or cream-colored, except the one central, neutral flower, which is blood-red. The umbels terminate the long, leafless branches, and are solitary, large, dense, concave, and many-rayed. The general involucre is pinnatifid, slender, and large, though not so long as the umbel; the partial involucre is undivided, or partly 3-cleft, and membranous at the edges; the petals, 5 in number, are obovate and emarginate, with an inflected point. Fruit small, oval, somewhat compressed, and pale dull-brown; the half-fruits or mericarps with the 5 primary ridges, filiform and bristly, the 3 middle ones at the back, the lateral on the plane of the commissure; the 4 secondary equal, more prominent, winged, and split into a single row of spines. The vittæ are solitary in the channels below the secondary ridges (L.—W.—G.).

History.—Wild carrot is indigenous to Europe, and is extensively naturalized in this country, growing in old fields and by roadsides, flowering from June to September. By cultivation it becomes somewhat changed, as in the garden carrot. The root of the wild variety, and the seeds of both kinds are employed.

Description.—CARROT SEEDS. The seeds or mericarps are oval, with plano convex surfaces, slightly ciliated, and marked with 5 ridges, from 1 to 1½ lines long, of an agreeable, aromatic smell, and a moderately pungent, bitter taste (*Ed.*). Their medicinal properties are owing to a volatile oil, which is colorless, or slightly tinged with yellow, and which may be procured by distilling them with water. They yield their virtues by infusion, to water, at 100° C. (212° F.); boiling dissipates them. No particular analysis has been made of them.

CARROT ROOT.—The root is fusiform, slender, yellowish-white, occasionally branched, rather woody, possessing a peculiar aromatic odor, and an unpleasant, bitterish taste, with some acrimony. The root of the garden carrot is fusiform, from 9 to 12 inches in length, white, orange, yellow, or reddish-colored, transversely wrinkled, with scattered radicles, having a reticulated bark or fleshy parenchyma, and a round or angularly radiated medulla; they are quite thick, have an agreeable, peculiar odor and a rather pleasant, saccharo-mucilaginous taste.

Chemical Composition.—According to Wackenroder, the expressed juice of carrot root contains fixed oil, with some volatile oil, a coloring matter termed by him *carotin*, uncrystallizable sugar, with some starch and malic acid, mannit, albumen, and ashes composed of salts of aluminum, calcium, and iron. It also contains *pectose*, a substance insoluble in water, alcohol, or ether, which gives the hardness to green fruits, and which may be converted into *pectin*. The volatile oil is of sp. gr. 0.8863 at 12.2° C. (54° F.), is very soluble in alcohol or ether, less so in water, is colorless, and has the odor and strong taste of carrots. *Carotin* ($C_{18}H_{24}O$, according to Husemann), is a ruby-red, crystalline, tasteless, odorless, neutral substance, heavier than water, fusible, combustible, soluble in fixed and volatile oils, benzol, and carbon disulphide, slightly so in alcohol, chloroform, and ether, insoluble in water; and its solutions are not decolorized by solar light. The solution in carbon disulphide is blood-red, and yields *carotin* as a precipitate upon the addition of alcohol. It undergoes a complete change when exposed to light, becoming colorless and amorphous, and much less soluble in carbon disulphide, but easily soluble in alcohol and ether (Husemann).

Another body, in the juice of the root, was investigated by A. Husemann, in 1860, named by him *hydrocarotin* ($C_{18}H_{30}O$), which is the same substance as that found by Brimmer in angelica root. From hot alcohol it crystallizes upon cooling in silky, colorless crystals, devoid of taste. Arnaud also obtained a body related to cholesterin, differing but little from the animal product of that name, but agreeing with the phytosterin obtained from the calabar bean (*Comptes Rendus*, cii, 1319). After repeated alcoholic purification it was obtained, combined with a molecule of water, in foliaceous condition.

Pectin or *vegetable jelly* is found universally scattered over the vegetable kingdom, being in considerable quantity in many fruits, roots, etc. It may be obtained from the juice of all fruits by (1) the cautious addition of oxalic acid to throw down their calcium salts; (2) then adding a concentrated solution of tannin so long as a precipitate occurs, of coagulated albumen; (3) separating the albumen by filtration, and then adding alcohol to the clear liquid, and leaving the solution for a couple of days to spontaneous evaporation, when the pectin is deposited in a gelatinous coagulum; to obtain it in purity, subject it to gradual pressure, and wash it with weak alcohol. It is translucent like isinglass, swells in 100 parts of cold water, forming a mass like starch, but not colored blue by iodine; boiling water has less action upon it than cold. It is insoluble in alcohol or ether, and has no action on polarized light. The least trace of a fixed alkali instantly converts it into pectic acid, forming a pectate of the alkali, the addition of another acid decomposes it, and sets the pectic acid free. *Pectic acid* has the form of a transparent and colorless jelly, with a perceptible acid taste, reddens litmus, and forms salts with alkalies (T.).

Action, Medical Uses, and Dosage.—Both the root and seeds are mildly stimulant and diuretic. Used in infusion with much success, in *dropsy, chronic nephritic affections*, and *gravel*. Also as a carminative, and to relieve *strangury* from cantharides. Carrot is said to possess emmenagogue properties, and the juice is reputed to relieve *pruritis*, accompanying some forms of skin disease. Externally, scraped or grated, it forms an excellent application as a poultice to *phagedenic, cancerous, malignant*, and *indolent ulcers*—relieving the pain, correcting the fetor, lessening the discharge, and altering the morbid condition of the parts. Dose of the infusion (℥j to water Oj), from 2 to 4 fluid ounces, 3 or 4 times daily; of the powdered seeds, 20 to 60 grains.

CARTHAMUS.—DYER'S SAFFRON.

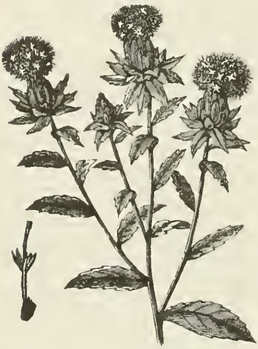
The florets of *Carthamus tinctorius*, Linné.

Nat. Ord.—Compositæ.

Common Names and Synonym: *Safflower, Bastard saffron, Dyer's saffron, African saffron, False saffron, American saffron; Flores carthami.*

Botanical Source.—Carthamus tinctorius is an annual plant, with a smooth stem, growing from 1 to 2 feet high, striate, and branching at the top. The leaves are alternate, ovate-lanceolate, sessile, spinose-denticulate, subamplexicaul, smooth and shining. The flowers are numerous, long, slender, orange-colored, and borne in large, terminal, discoid heads. The florets are tubular; the corolla infundibuliform and 5-cleft (W.).

Fig. 58.



Carthamus tinctorius.

History and Description.—This plant is cultivated in this country and Europe, though inhabiting Egypt and the countries surrounding the Mediterranean Sea. The orange-red florets are the medicinal parts, and are generally met with in commerce in laminated masses, with the yellow filaments accompanying. Their odor is peculiar and aromatic, and the taste slightly bitter. Dyer's saffron is sometimes used to adulterate genuine saffron, but may be detected by the cannular form of the flowers, the reddish-yellow color of their stamens and pistils, and the absence of the white ends belonging to the true saffron. The cultivated safflower in this country is usually sold unpressed, as American saffron.

Chemical Composition.—Safflower contains 2 coloring matters: the first, which is soluble in water, is yellow (called *Safflor yellow*); the other has a beautiful red color, greenish in reflected light, is insoluble in water, fixed and volatile oils, ether, and in diluted acids, is slightly soluble in alcohol, but readily soluble in alkaline solutions, in which, however, it readily decomposes, with discharge of the color, and is termed *carthamin*, or *carthamic acid* ($C_{14}H_{16}O_7$). Its acid properties are feeble. Dried and mixed with French chalk, it constitutes rouge, which is used as a cosmetic. *Carthamin* is the valuable dye constituent. Both carthamin and safflor yellow were investigated particularly by Schlieper. The former exists in small amount (0.3 to 0.6 per cent); the latter is abundant (25 to 30 per cent).

Action, Medical Uses, and Dosage.—Dyer's saffron, when the warm infusion is used, is said to restore the menstrual discharge which has been recently suppressed by cold; also when taken largely, to produce an action on the bowels. The warm infusion is often employed as a diaphoretic in domestic practice among children and infants in *measles, scarlet fever*, and other *eruptive maladies*. It may be given tolerably freely. The infusion may be made by infusing 1 or 2 drachms of the flowers in ½ pint of boiling water. The seeds are white and angular, and have been much used as a purgative and emmenagogue. They yield an oil by expression, which has been used as a local application in *rheumatic* and *paralytic affections;* also for *bad ulcers*.

CARUM (U. S. P.)—CARAWAY.

The fruit of *Carum Carvi*, Linné (*U. S. P.*) (*Carum Carui*, Linné).

Nat. Ord.—Umbelliferæ.

Common Names: *Caraway-seed*, *Caraway-fruit.*

Illustrations: Bentley and Trimen, *Med. Plants*, 121; Köhler's *Medizinal Pflanzen*, Vol. I, Plate 91.

Botanical Source.—Carum Carvi (Carui) is a biennial plant, with a fusiform, fleshy root, and a stem about 2 feet high, erect, branched, leafy, angular, and furrowed. The lower leaves are nearly a span long, bright-green, petioled, doubly pinnate, with numerous opposite, finely-cut leaflets, of which the pairs next the midrib cross each other; those on the stem are much smaller, opposite, and very unequal. The umbels are numerous and erect. General bracts, if present, capillary, connected, when more than 1, by a membranous base. The flowers are numerous, white, or pale flesh-colored; marginal ones only perfect and prolific. Peduncles very small and convex. Calyx extremely minute; petals 5, obovate, inflexed. Stamens as long as the petals; anthers small, bilobed; ovary ovate. Fruit, or mericarps, narrow, bright-brown, elliptic-ovate, about 2 lines long, with pale, elevated, filiform ridges, and shining convex channels (L.).

History.—Caraway is indigenous to Europe, growing in the meadows and on the mountains of the South of France, and flowering from April to July. It is cultivated and appears wild also in Iceland, Scandinavia, throughout Russia, in Siberia, Persia, and the Caucasus. It grows wild in the Himalayas, and a peculiar form, an *annual*, differing in many ways, yet belonging to this species, is cultivated near Morocco. Caraway is also cultivated in Great Britain, Germany, Holland, and the United States. Its seeds are completed in the second year of its growth, when they mature in the latter part of summer. They are procured by beating the plant, after it has been removed from its place of growth. They are termed mericarps.

Description and Chemical Composition.—"Oblong, laterally compressed, about 4 or 5 Mm. ($\frac{1}{6}$ to $\frac{1}{5}$ inch) long, usually separated into the 2 mericarps, which are curved, narrower at both ends, brown, with 5 yellowish, filiform ribs, and with 6 oil tubes. Caraway has an agreeable odor, and a sweetish, spicy taste"—(*U. S. P.*). The virtues of caraway fruit are due to a volatile oil (see *Oleum Carvi*), and are readily yielded to alcohol or ether. The oil is at first pale, becomes darker by age, and has the peculiar fragrance and taste of the seed. The immature fruits are rich in tannin. Resin, wax, mucilage, sugar, and a greenish fixed oil, were shown by Trommsdorff to exist in the fruit.

Action, Medical Uses, and Dosage.—Caraway is an aromatic carminative, used in *flatulent colic*, especially of children, and to improve the flavor of several medicinal compounds. The oil (*Oleum Carui*) is more generally used. The seeds are frequently added to cakes and confectionaries, to render them more agreeable, while, at the same time, they gently excite the digestive powers. Dose of the seeds, from 10 to 60 grains.

CARYOPHYLLUS (U. S. P.)—CLOVES.

"The unexpanded flowers of *Eugenia aromatica* (Linné), O. Kuntze"—(*U. S. P.*). (*Eugenia caryophyllata*, Thunberg; *Caryophyllus aromaticus*, Linné; *Myrtus caryophyllatus*, Sprengel).

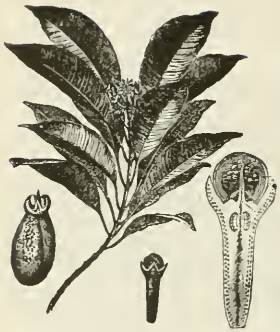
Nat. Ord.—Myrtaceæ.

Common Name and Synonym: *Cloves; Caryophylli aromatici.*

Illustration: Bentley and Trimen, *Med. Plants*, 112.

Botanical Source.—Eugenia aromatica is a beautiful tree, rising to the height of 15 or 20 feet. It is of a conical or pyramidal form, evergreen, and the whole plant is glabrous. Its branches are numerous, slender, opposite, and more or less virgate. The wood of the stem is hard; the bark grayish and smooth. The leaves are opposite and decussate, persistent, somewhat coriaceous and shining, minutely punctated, about 4 inches long and half as broad, ovate-lanceolate, more or less

Fig. 59.



Eugenia aromatica, with fruit; and mother clove (to the left).

acute, quite entire, pale beneath, and tapering gradually at the base into a slender foot-stalk, which is nearly 2 inches long. The flowers are very odoriferous, and are in short, terminal, many-flowered panicles, trichotomously divided and jointed at every division. Peduncles terete and green. The calyx is composed of 4 ovate, concave segments, erecto-patent, placed upon the top of the ovary, and together with it, is first green, and then red and coriaceous. The petals are 4, larger than the calyx, imbricated into a globe in bud, at length spreading, roundish, concave, yellowish-red, and very soon caducous. In the center of the calyx, and occupying the top of the ovary, is a quadrangular, elevated line or gland, surrounding, but not embracing, the base of the shortish, obtusely-subulate style. Around this gland, immediately within the petals, the stamens are inserted. These are longer than the petals, yellow, and with small, yellow, ovate-cordate, 2-celled anthers. The ovary is oblong, almost cylindrical, and 2-celled, with many small ovules in each cell. The berry is purplish, elliptical, and 2-seeded. The seed is covered with a thin integument of a soft texture (L.).

History.—A tall and beautiful tree, growing in tropical climates, extinct in its first habitat (Clove Islands), but introduced and extensively cultivated on the East Africa coast, and in the East and West Indies, and Brazil. The cultivated tree, from which the cloves are gathered, is not so tall as in the wild state, but its aromatic properties are much more pronounced. The flowers are collected twice yearly, in June and December, before they are fully developed, and just as they become bright-red, being either hand-picked or knocked from the tree with bamboo poles, falling upon a cloth outstretched to receive them. They consist of a tubular calyx, bearing a roundish bud of unexpanded petals; they are quickly dried in the sun, becoming thereby brown. The finest kinds are plump, heavy, and dark, and give out oil when squeezed with the nail. These are usually from East Africa and the Moluccas. A lighter-colored, shrunken variety comes from South America and the West Indies. Occasionally cloves from which the oil has been partially extracted, appear in market mixed with the better qualities. As a rule, they are deprived of their heads, and are in a moist state.

Description.—"About 15 Mm. ($\frac{1}{2}$ inch) long, dark-brown, consisting of a subcylindrical, solid and glandular calyx-tube, terminated by 4 teeth, and surmounted by a globular head, formed by 4 petals, which cover numerous curved stamens, and 1 style. Cloves emit oil when scratched, and have a strong, aromatic odor, and a pungent, spicy taste"—(*U. S. P.*). They yield their virtues to alcohol, spirit, and ether; water merely acquires their aroma.

Chemical Composition.—Cloves contain volatile oil, fixed oil, a peculiar tannin, gum, resin, fiber, water, and two crystalline principles called *caryophyllin* ($C_{20}H_{32}O$) and *eugenin* ($C_{10}H_{12}O_2$) (Trommsdorff). *Caryophyllin* is a camphor-like body which occurs in silky, needle-like prisms, without taste or odor, and of neutral reaction. It was isolated by Lodibert in 1825. *Eugenin* occurs in pearly white laminæ, without taste. It was obtained in 1833, from the aqueous distillate of cloves, by Dumas, and named by Bonastre. Caryophyllin may be prepared by treating cloves previously deprived of the greater part of their volatile oil by means of a small quantity of alcohol, with hot ether. When treated with nitric acid it yields crystalline *caryophyllinic acid* ($C_{20}H_{32}O_6$) (E. Mylius, 1873). The active properties reside in the volatile oil, which is colorless or of a pale-yellow color, darkens by age, and is heavier than water. The yield from cloves is from 16 to 20 per cent. It is extremely pungent and acrid, and its principal constituent is *eugenol* ($C_{10}H_{12}O_2$), a fluid body (see *Oleum Caryophylli*).

Action, Medical Uses, and Dosage.—Aromatic, stimulant, and irritant. Used to allay *vomiting* and *sickness at stomach*, to stimulate the digestive functions, and to improve the flavor or operation of other remedies, and prevent a tendency to their producing sickness or griping. Dose, from 5 to 10 grains.

Substituted Drugs and Related Species.—Clove Stalks. The dividing flower-stalks of cloves are frequently powdered to adulterate ground cloves, and occasionally are met in commerce intact. They have a pale-brownish hue, are about a line in thickness, and possess the characteristic clove taste and odor, though in feeble degree as compared with genuine cloves. They yield about ⅕ as much essential oil as the latter, and are used to some extent in the distillation of clove oil. Their presence in powdered cloves may be shown microscopically by stone-cells (examined in glycerin after being treated with caustic potash), which are not found in clove-buds.

Mother Cloves, *Anthophylli*.—Nearly ripe, dried *clove-fruits*. Oblong-oval, calyx-crowned, nearly an inch in length, resembling cloves to some extent, though yielding much less clove-oil. Microscopically detected in ground cloves by starch-cells of large size.

Royal Cloves, *Caryophyllum regium*.—A monstrosity clove, small, having imperfect floral organs, sepals abnormal, and calyx-tube with bracts at base. Rare (*Pharmacographia*).

Allspice (see *Pimenta*).—Occasionally used as an adulterant of ground cloves. Microscopically shown by starch-cells, together with stone-cells.

Dianthus Caryophyllus.—The *clove pink*, selecting the deep-red and most fragrant flowers, is used in Europe to flavor and color a syrup.

CASCARILLA (U. S. P.)—CASCARILLA.

"The bark of *Croton Eluteria*, Bennett" (*U. S. P.*) (*Clutia Eluteria*, Linné).

Nat. Ord.—Euphorbiaceæ.

Common Names and Synonyms: *Sweet-wood tree, Cascarilla-bark tree, Eleuthera-bark tree; Cascarillæ cortex* (*Br.*), *Cortex eluteriæ, Cortex thuris.*

Illustration: Bentley and Trimen, *Med. Plants*, 238.

Botanical Source.—Croton Eluteria is a small tree, said to rise to the height of 20 feet, and branching thickly at the top. The branches and twigs are angular, rather compressed, striated, downy, and ferruginous. The leaves are petiolated, alternate, ovate, with a short, but obtuse point, entire, slightly nerved, bright-green above, with a few scattered leprous dots, silvery, and very downy beneath. The petioles are short and scurfy. The racemes are axillary and terminal, branched or compound; the branches short, divaricating, and covered with numerous, closely-parted, subsessile, whitish, monœcious flowers. The sterile flowers are above and smallest; the fertile ones below, few, and on short stalks. The stamens, 10 to 12. The capsule is roundish, minutely warted, scurfy, and not much larger than a pea, with 3 furrows, 3 cells, and 6 valves (L.).

History.—The tree from which cascarilla is obtained is a native of the West Indies, and is found plentifully in the island of Eleutheria, from which it derives its name. It was, for a time, supposed to have been derived from the *Croton Cascarilla*, a small tree growing in the Bahamas, Hayti, Peru, and Paraguay, but this is now ascertained by botanists to have been an error. Cascarilla bark is imported from the Bahama Islands, Jamaica, etc. At one time it was known as *China nova*, on account of the resemblance of the external portion of the bark to that of cinchona, the latter having been adulterated and even substituted with cascarilla bark. The name *China nova* was subsequently applied to the bark of *Buena magnifolia*, Weddell, a South American tree, noted for the magnificence of its foliage and the fragrance of its flowers (*Pharmacographia*). Our Pharmacopœial name—*Cascarilla*—is scarcely known in the Bahama Isles, the drug being there known as *Eleutheria*, or *Sweet-wood bark*. The name *Cascarilla* was first used in connection with cinchona bark, to which, by priority, it should apply, but it is now applied wholly to the sweet-wood bark. It signifies (Spanish) "*little bark*" (*Ibid*).

Description.—Cascarilla bark occurs "in quills, or curved pieces, about 2 Mm. ($\frac{1}{12}$ inch) thick, having a grayish, somewhat fissured, easily detached, corky layer, more or less coated with a white lichen, the uncoated surface being dull brown, and the inner surface smooth. It breaks with a short fracture, having a resinous and radially striate appearance. When burned, it emits a strong, aromatic, somewhat musk-like odor; its taste is warm and very bitter"—(*U. S. P.*). On account of its agreeable odor when burned, resembling that of musk, vanilla, or amber when heated, it is often added in small portions to tobacco, by smokers, to render the fumes more fragrant, but it produces unpleasant symptoms if used too freely. Water or spirit readily extracts its active principles, but diluted alcohol is the preferable menstruum.

Chemical Composition.—Trommsdorff found the bark to contain volatile oil, bitter resin, gum, and bitter matter with a trace of chloride of potassium, and woody fiber. Messner found oxide of copper in its ashes. Brandes detected a peculiar substance, *cascarilline*, which he took to be an alkaloid. Duval has found a neutral principle which he calls *cascarillin*, a disagreeable, fatty substance, an acid very much resembling tannic acid, etc. Cascarilla resembles salicin in many respects (*Amer. Jour. Pharm.*, Vol. XVII, 1845). In 1882, Alessandri, by abstracting the bark with a 2 or 3 per cent solution of oxalic acid, obtained a substance similar in behavior to Duval's cascarillin, with the difference, however, that Alessandri's substance was basic, evolving ammonia by warming with caustic potash, and forming salts with acids. R. A. Cripps, in 1886, could not obtain such a body. C. and E. Mylius, in 1873, confirmed Duval's observation as to the absence of nitrogen in *cascarilline*, for which they establish the formula $C_{12}H_{18}O_4$. Naylor and Littlefield obtained a purified *cascarillin*, having a melting point of 203.5° C. (398.3° F.), and the formula $C_{16}H_{24}O_5$. It yields a distillate related to anthracene ($C_{14}H_{10}$), when heated with zinc dust (*Amer. Jour. Pharm.*, 1896). Conrady found *vanillin* in cascarilla bark (1895).

Action, Medical Uses, and Dosage.—Tonic and stimulant. Used in *dyspepsia*, *flatulency*, *chronic diarrhœa*, in *debility* attending chronic diseases, convalescence from acute diseases, and to arrest *vomiting*. When cinchona produces nausea, the addition of cascarilla will prevent it. Dose of the powder, from 20 to 40 grains; of the tincture, from 1 to 4 fluid drachms; of the infusion, from 1 to 4 fluid ounces. On account of its musky odor, it is a common ingredient of fumigating pastiles.

Related Species.—*Croton pseudo-china*, Schlechtendal (see *Aspidosperma*),

Croton Malambo, Karsten, *Malambo bark*. Venezuela. Bark resembles cascarilla in taste and odor. It is quilled, brown externally, and transversely grooved. Grayish-brown internally, and finely marked with striæ. The cork-layer is nearly white, soft, not thick, and fissured lengthwise. It has an abrupt splintery fracture. Used by the natives in *dysentery*, *atonic dyspepsia*, *worms*, *spasms*, *yellow* and *intermittent fevers*, *asthma* and *trismus nascentium*

CASSIA FISTULA (U. S. P.)—CASSIA FISTULA.

"The fruit of *Cassia Fistula*, Linné" (*U. S. P.*) (*Bactyrilobium Fistula*, Willdenow; *Cathartocarpus Fistula*, Persoon).

Nat. Ord.—Leguminosæ.

Common Name and Synonym: *Purging cassia; Fructus cassiæ fistulæ.*

Illustration: Bentley and Trimen, *Med. Plants*, 87.

Botanical Source.—Cassia fistula is a tree growing from 20 to 40 feet high, with many spreading branches toward the summit. The wood is hard and heavy. The leaves pinnate, alternate, from 12 to 18 inches long, and deciduous; the leaflets opposite or nearly so, from 4 to 8 pairs, the lower ones broad-ovate, smooth, obtuse, or emarginate, polished on both sides, on short, round petioles, from 2 to 6 inches long, and from 1½ to 3 broad. The flowers are large, fragrant, bright-yellow, and borne on long, slender, smooth pedicels. The racemes are axillary, pendulous, simple, and 1 or 2 feet long. The calyx is composed of 5 nearly equal, oblong, obtuse, smooth sepals. The corolla consists of 5 petals, which are oval, unequal, concave, spreading, and waved. The 3 lower filaments, much longer than the others, have a double curve, but no swelling. The anthers on the 3 long filaments are oblong, opening by 2 lines on the face, while the other 7 are clavate, with pores at the small end. The ovary is filiform, smooth, cylindrical, curved, and 1-celled, containing numerous seeds. The fruit is a woody, dark, blackish-brown, cylindrical pod or legume, a foot or more in length, about an inch in diameter, terete, smooth, blunt, indehiscent, filled with a viscid, reddish-black, sweetish pulp, divided into many cells by hard, transverse phragmata; the cells 1-seeded; and the seed oval, glossy, and somewhat flattened (L.).

History.—Purging cassia inhabits Egypt and the Indies, and has become extensively diffused in various tropical countries, as China, Hindustan, West Indies, Brazil, etc. The part used in medicine is the fruit or pods, and those are to be preferred which are heavy and new, and do not, when shaken, make a rattling noise from the seeds being loose within them. The pulp should be of a bright, shining, black color, and have a sweet taste, neither harsh, from the fruit being collected before it is fully ripe, nor at all sourish, which it is apt to become on keeping, nor at all moldy, which is frequently the case when kept in damp cellars, or moistened to increase its weight (*Ed.*) To obtain the pulp, the pods are pounded, so as to break their outer coat, and then they are infused in boiling water, which dissolves the pulp; the infusion is then strained, and evaporated to the proper consistence.

Description.—"Cylindrical, 40 to 60 Cm. (16 to 24 inches) long, nearly 25 Mm. (1 inch) in diameter, blackish-brown, somewhat veined, the sutures smooth, forming two longitudinal bands; indehiscent, internally divided transversely into numerous cells, each containing a reddish-brown, glossy, flattish-ovate seed imbedded in a blackish-brown sweet pulp; odor resembling that of prunes"—(*U. S. P.*).

Chemical Composition.—The pulp has a feeble, nauseous odor, a mucilagino-saccharine taste, and contains, according to Henry, sugar, gum, impure tannic acid, coloring matter, a gluten-like matter, and moisture. It keeps longest when preserved in the pod. It is largely soluble in water, and its active parts are taken up by alcohol.

Action, Medical Uses, and Dosage.—One or two drachms act as a mild and effectual laxative; 1 or 2 ounces are cathartic, but excites nausea, flatulence, gripings, etc. (*Ed.*). It tints the urine brown or green. It is generally employed only in the electuary of senna.

Related Species.—*Cassia moschata*, Kunth (*Cathartocarpus moschatus*, Don). Central and northern South America. Yields a purging cassia, resembling the official, though not quite so uniformly straight, and is from a foot to nearly 20 inches long, and of a light color. Its pulp is sweet, subastringent, and of a reddish-brown color. A sandal-wood fragrance is emitted when the crushed legumes are heated in a water-bath (*Pharmacographia*).

Cassia bacillaris, Linné filius (*Cathartocarpus bacillus*, Persoon).—Yields a drug essentially corresponding with the preceding.

Cassia brasiliana, Lamarck (*Cassia grandis*, Linné filius; *Cathartocarpus brasiliana*, Persoon; *Cassia mollis*, Vahl), *Horse cassia*.—Brazil and Central America. Larger than purging cassia legumes; sutures prominent, and pulp astringent, bitter, and purgative. They are compressed, may be curved, and have dividing veins running transversely.

Ceratonia siliqua, Linné.—Mediterranean countries. An evergreen tree bearing purple, apetalous flowers, and producing a fruit known as *St. John's bread*, somewhat resembling purging cassia. Employed in Europe in connection with demulcents and pulmonary mixtures. Besides sugar and glucose, mucilage, tannic acid, and proteids, the fruit contains free isobutyric acid ($[CH_3]_2CH.COOH$). A more recent analysis of Ceratonia siliqua is recorded in the *Amer. Jour. Pharm.*, 1893, p. 131.

CASSIA MARILANDICA.—AMERICAN SENNA.

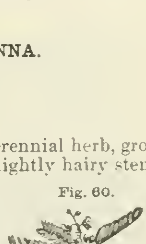
The leaves of *Cassia marilandica*, Linné.

Nat. Ord.—Leguminosæ.

COMMON NAMES: *American senna*, *Wild senna*.

Botanical Source.—Cassia marilandica is an American, perennial herb, growing from 4 to 6 feet high, with round, striated, smooth, or slightly hairy stems. The leaves are alternate, on long petioles, at the base of which is a large, ovate, shining green gland, terminating in a dark point at top, which is sometimes double; each petiole contains from 8 to 10 pairs of leaflets, which are oblong, smooth, entire, mucronate, somewhat hairy at the edges, 1 or 2 inches long, and from 5 to 10 lines broad. The flowers are bright yellow, in axillary racemes, extending quite to the top of the stem; the peduncles are slightly furrowed, and marked with minute, blackish, glandular hairs; sepals 5, oval, obtuse, the lateral ones longest. Petals 5, concave, and very obtuse. Stamens 10, the 3 upper have short abortive anthers; to these succeed 2 pairs of deflexed, linear, brown anthers; the remaining lowermost 3 taper into a sort of beak, the middle one being shortest. The fruit is a legume, from 2 to 4 inches long, pendulous, linear, curved, swelling at the seeds, furnished with slight hairs; seeds many (L.). It is sometimes called wild senna.

Fig. 60.



Cassia marilandica.

History and Chemical Composition.—This plant is frequently met with in alluvial soils, and in stony situations, from New England to North Carolina, flowering from June to September, about which time the medicinal parts of the plant should be gathered. The leaves yield their properties to alcohol or water; they are nearly odorless, have a senna-like, mawkish taste, and in medicinal power are equal to foreign senna. Mr. Martin, of Philadelphia, found the leaves to contain albumen, mucilage, starch, chlorophyll, yellow coloring matter, volatile oil, fatty matter, resin, lignin, salts of potassium and calcium, and a principle resembling *cathartin* (*Amer. Jour. Pharm.*, Vol. 1, p. 22). It is also thought to contain *chrysophan* and *cathartic acid* (*Amer. Jour. Pharm.*, 1888, p. 231).

Action, Medical Uses, and Dosage.—An excellent cathartic, equal to the imported article, for which it may be substituted. But owing to the presence of argel leaves, much of the foreign senna has its activity increased; hence, in giving the American article, its dose must be somewhat increased. It may be given in powder or infusion, and should be combined with aromatics to prevent any proneness to griping. The dose in powder is from ½ to 2½ drachms. The infusion may be made by adding 1 ounce of the leaves, with 1 drachm of coriander seeds, to 1 pint of boiling water. Macerate for an hour in a covered vessel and strain; dose, 4 or 5 fluid ounces.

Related Species.—*Cassia Chamæcrista*, Linné. *Prairie senna* or *Partridge pea*, growing on the western prairies, is an excellent substitute for the above; it is likewise known as *Dwarf cassia* and *Sensitive pea*.

CASTANEA (U. S. P.)—CASTANEA.

"The leaves of *Castanea dentata* (Marshall) Sudworth; collected in September or October, while still green"—(*U. S. P.*). *Castanea vesca* (Gaertner), var. *Americana*, Michaux; *Castanea vesca*, Michaux (*Sylv.*, Vol. III, p. 11); *Fagus Castanea*, Linné; *Castanea vulgaris*, Lamarck; *Fagus Castanea dentata*, Marshall).

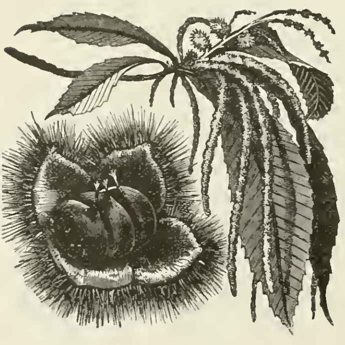
Nat. Ord.—Cupuliferæ.

Common Name: *Chestnut.*

Illustrations: *Flora of New York*, Plate 111; Michaux's *Sylv.*, Vol. III, Plate 104; Emerson's *Trees of Mass.*, p. 187.

Botanical Source.—This is a large, well-known tree, the flowers of which appear in June and July, after the leaves are full grown, and when all other forest trees have blossomed; they are small, apetalous, and monœcious. The sterile flowers are very numerous, in long, erect, white, rigid aments, which emit an unpleasant odor. The stamens are from 8 to 20, and have slender filaments. The fertile flowers are 2 or 3, enclosed in a scaly involucre. The fruit is a 4-valved burr, armed on the outside with stiff, sharp, bristles, and lined on the inside with a soft, velvety pubescence. It encloses 3 (or often, by abortion, 1 or 2) edible nuts. The leaves are alternate, lanceolate, and coarsely toothed, tapering to a slender point, and are borne on leaf-stalks about ½ inch long; the veins are parallel, rigid, and terminate in the mucronate points of the teeth.

Fig. 61.



Castanea dentata.

History.—The chestnut is a large tree, originally a native of Asia Minor, but introduced and extensively naturalized in the temperate parts of Europe. The American tree (var. *Americana*, Michaux), differs slightly from the European, in having smaller fruit, and leaves acute at the base. It is found from Maine to the gulf states, being especially abundant in the Alleghany regions.

Chestnut leaves should be gathered in the fall, before frost, and carefully dried in the shade. They are of a greenish color, and exhale a pleasant, tea-like odor. At first, slightly astringent to the taste, they become mucilaginous and sweetish when chewed, leaving an after-taste, very much resembling that of *Solanum Dulcamara*.

Description and Chemical Composition.—"From 15 to 25 Cm. (6 to 10 inches) long, about 5 Cm. (2 inches) wide, petiolate, oblong-lanceolate, acuminate, mucronate, feather-veined, sinuate-serrate, smooth; odor slight; taste somewhat astringent"—(*U. S. P.*). The chief constituent of chestnut leaves is a mucilaginous subtance which is slowly extracted from the shredded leaves by means of cold water, and more freely by hot, but which is insoluble in alcohol. Any preparation of the leaves which does not contain this material will fail to relieve the paroxysms of whooping-cough, and, for this reason, but little alcohol is admissible in the fluid extract, and thus, undoubtedly, the best preparation is freshly prepared infusion or decoction. Chestnut leaves also contain an astringent principle, and a sweet substance, the other constituents seeming to be simply those found in most plants. The ash consists of potassium, calcium, magnesium, and iron salts. The testa of the seeds is said to contain a bitter principle.

Action, Medical Uses, and Dosage.—Chestnut leaves appear to have been brought into notice, as a therapeutical agent, by Mr. G. C. Close, in a statement before the American Pharmaceutical Association, in 1862. Subsequently, they were employed by the late Dr. J. S. Unzicker, of Cincinnati, who valued them highly in the treatment of *whooping-cough;* since which, most favorable reports have been made by other physicians, as to their value. These leaves have, thus far, been employed mainly in the treatment of *pertussis*, in which malady they have proved remarkably efficient; but their manner of action has not yet been determined. It is very probable that they may be found useful in other irritable or excitable conditions of the respiratory nerves. Dr. Unzicker employed an infusion of the leaves, an ounce to a pint of boiling water, and administered this in tablespoonful, or small wineglassful doses, repeated several times a day. The fluid extract, when properly made, will be found reliable; its dose is from ½ to 1 fluid drachm, repeated 3, 4, or 5 times daily. Chestnut bark appears to possess astringent and tonic properties, and is used in some sections of our country as a popular remedy for *fever* and *ague*. Other forms of paroxysmal or convulsive *cough* resembling pertussis have been cured with it. Prof. Scudder (*Spec. Med.*, p. 103), suggests a trial of the remedy in cases exhibiting unsteadiness of gait and a disposition to turn to one side.

Specific Indications and Uses.—Paroxysmal, convulsive cough; pertussis.

Related Species.—*Castanea pumila*, Michaux (*Fagus pumila*, Linné), an allied species commonly called "*Chincapin*," or "*Chinquapin*," is a shrub or small tree found in sterile places from Ohio southward. The flowers, leaves, and fruit of this species bear a close resemblance to those of *C. dentata*, but are all smaller. The fruit encloses but a single seed, which is not flattened as are the seeds of *C. dentata*. (For a monographic description, see Henry Kraemer, *A. P. A. Proc.*, 1895.)

CASTOREUM.—CASTOR.

The præputial follicles (dried), with their secretions, taken from the common beaver, *Castor Fiber*, Linné. (*Castor americanus*, Cuvier).

Class.—Mammalia. *Order.*—Rodentia.

Source, History, and Description.—This drug is a peculiar solidified secretion procured from peculiar follicles, two in number, connected with the external genital organs of the *Castor Fiber*, or *Beaver*. These follicles are filled with a thick fluid secretion, which slowly concretes when they are removed from the animal. Most of the castor of the present day is derived from the beaver of North America. It has much the appearance of a pair of dried testicles united by their spermatic cords, dark liver-brown and wrinkled externally, paler liver-brown internally, resinous in fracture, when perfectly dried of a strong, peculiar heavy odor, and an aromatic, bitter, offensive taste. Rectified spirit is its best solvent; though ether extracts a good part of its virtues.

The Russian castor, from the Russian dominions, is seldom seen in this country; it may be distinguished from the American by being more fully developed, weightier, and less cohesive, by its more powerful odor, resembling that of

Russian leather, and its taste, and by effervescing with hydrochloric acid. The American castor gives a white precipitate with aqua ammoniæ, the Russian, an orange-yellow. Castor deteriorates by age, which is hastened by elevated temperatures; a damp atmosphere readily spoils it. When kept in a cool situation, in well-closed vessels, its virtues will continue uninjured for some years. A tasteless and inodorous article is inert. A spurious castor is sometimes met with, which is composed of several drugs combined, intermixed with dried laminæ of mucous tissue, odorized by a small portion of good castor, and then placed within a goat's scrotum. The deficiency of the little follicles which hold a fatty substance, the faint smell, and the feeble castor taste, and the want of other determinate characters, will at once expose the imposture (P.—*Ed.*). On the other hand, W. Fossek observed a pathological specimen of Russian origin, which was decomposed and contained 21 per cent ash, as against only 2 per cent from good castoreum; this was due to the formation of globular pathological concretions containing calcium (*Amer. Jour. Pharm.*, 1892).

Chemical Composition.—Castor is composed of numerous salts, mucus, a volatile oil, a resinous substance (to which its acrid bitterness is due), a horny matter, osmazome, and a peculiar crystalline, non-saponifiable principle called *castorin.* Wöhler detected *salicin* and *carbolic acid* in castor. The former is probably derived from the food of the beaver, which lives on salicin-producing barks; and carbolic acid is thought by Lehmann, to be derived from the birch-wood fires over which the drug is dried. Wöhler also found *benzoic acid* present. Pereira found salicyl-aldehyde in *Aqua Castorei* prepared from American castor.

Action, Medical Uses, and Dosage.—Mildly stimulant, antispasmodic, and emmenagogue. Used in *hysteria*, *amenorrhœa*, *epilepsy*, and many irregular *nervous affections.* Dose of the drug, from 10 to 20 grains; of the tincture, from ½ fluid drachm to 2 fluid drachms.

Cramer, in 1888, claims to have discovered in the tincture of castor (castor 1, alcohol 5) a remedy for breaking off the *morphine habit* (*Amer. Jour. Pharm.*, 1888, p. 177). It has also been used among the Cree Indians to prepare a poultice for *sprains* (*Amer. Jour. Pharm.*, 1884).

CATALPA.—CIGAR TREE.

The bark of *Catalpa bignonioides*, Walter (*Catalpa syringæfolia*, Sims; *Bignonia Catalpa*, Linné; *Catalpa cordifolia*, Nuttall).

Nat. Ord.—Bignoniaceæ.

COMMON NAMES: *Cigar-tree, Catalpa-tree, Bean-tree, Indian bean-tree.*

ILLUSTRATIONS: Michaux, *F. Sylv.*, Vol. II, Plate 64; *Bot. Mag.*, Plate 1094.

Botanical Source.—This handsome tree has leaves that are large, heart-shaped, opposite or disposed in whorls of 3. The flowers appear in June and July, and are produced in large, showy, terminal, compound panicles. The corollas are about an inch long, white, tinged with purple, and studded with orange spots in the tubes. They are bell-shaped, with a swollen tube, irregularly 5-lobed and 2-lipped. The fruit is a slender, 2-celled capsule, about 1 foot long, ¼ of an inch thick, and hangs suspended until spring. The seeds are numerous and winged.

History.—This tree is a native of the southern United States, but is cultivated as an ornamental tree and frequently naturalized in the northern states. It belongs to the natural order *Bignoniaceæ*, and, except a western states species, the *Catalpa speciosa* of Warder, is the only indigenous species of Catalpa, although others are found in Asia and the West Indies. The tree is called "cigar-tree," or "bean-tree," names derived from the slender fruit. The fruit and seeds have also been used.

Description.—The bark of the trunk is scaly, brown, and from 3 to 6 lines in thickness. That of the young limbs, is smooth, dark-grayish, and spotted with lighter colored excrescences. The young bark, and the inner portion of the old, is bitter. Catalpa wood is very durable, rivalling cedar. It is hard, grayish, and of coarse fiber.

Chemical Composition.—In 1870, Eugene A. Rau (*Amer. Jour. Pharm.*) made an examination of the inner bark of the tree, and found it to contain tannin, and a nauseating matter soluble in ether. When this substance was boiled with water and oxide of lead, and then filtered, a yellowish solution was obtained, free from alkaloids, and very bitter. The precipitate that separated with the oxide of lead, gave to boiling alcohol a crystallizable, white, neutral substance, which possessed the nauseating bitter taste of the bark, and was soluble in ether and chloroform. In addition to the above, an insipid resin and glucose were obtained. The seeds, when extracted with a mixture of alcohol, ether, and ammonia, yielded several crystallizable principles (Brown, 1887). Sugar, tannin, resin, and fixed oil are also constituents of the seeds.

Action, Medical Uses, and Dosage.—It is stated that poisonous emanations issue from this tree, but we have no knowledge of any serious effects resulting from an exposure thereto. The pods and seeds have been employed in decoction in *chronic bronchial affections*, *spasmodic asthma*, and *dyspnœa*, and certain forms of *functional heart disease*; 6 or 8 ounces to a pint of water, and given in tablespoonful doses, repeated every 1 or 2 hours. The leaves, bruised, and applied as a cataplasm, have been used in *irritable scrofulous ulcers;* they appear to possess anodyne properties. The bark has been employed internally, in powder, or in decoction, in *scrofulous maladies*, and as an anthelmintic. The juice of the leaves, as well as of the root, has been beneficially employed as a local application in the several forms of *strumous ophthalmia*, as well as in certain *cutaneous affections*. From the statements that have been made as to the toxic properties of this tree, and which have not yet been satisfactorily demonstrated, it would be advisable to use some prudence and care in the internal administration of any of its preparations. Dose of specific catalpa, fraction of a drop to 20 drops.

Related Species.—*Bignonia capreolata*, Linné. Southern United States. *Trumpet creeper.* A shrub of climbing habit, bearing large orange-colored flowers. Aqueous preparations of the stems and root of this species have been used, according to Porcher, for the same purposes as sarsaparilla—*i. e.*, in *syphilis*, *chronic rheumatic complaints*, and other disorders dependent upon blood dyscrasia. It is reputed alterative, detergent, sudorific, and diuretic. A closely related plant is the *Tecoma radicans*, Jussieu, known as *Trumpet flower*.

CATAPLASMATA.—CATAPLASMS.

Synonym: *Poultices.*

Cataplasms, ordinarily called "poultices," are preparations designed to be applied externally for the purpose of producing relaxation, holding moisture, and allaying pain and inflammation. They are usually composed of substances capable of absorbing considerable fluid, and are applied either cold or warm, in a moist state. They should not be made so thin as to flow over the parts adjacent to their application, nor so thick as to become dry too rapidly; neither should they be composed of substances which stick too tenaciously to the skin and are not readily removed by water; nor of hard bodies. They should always be removed without being permitted to dry. Owing to the affections for which they are applied, and their influence upon these, they have received the several names of emollient, discutient, refrigerant, stimulating, etc. When applied to ulcers, tender and irritable parts, etc., it is customary to cover their surfaces with a little olive oil, in order to prevent adhesion to such parts. Poultices are commonly prepared by nurses, but physicians and druggists should be acquainted with their method of preparation.

Spongio-piline is sometimes applied to parts to absorb excessive moisture, or to prevent evaporation. It is a thick cloth composed principally of sponge, one side of which is applied to the skin in a wet or dry state, according to the action required; the other side being coated with some water-proof varnish, or with rubber. It may likewise be used to apply moisture to a part or may be saturated with medicated solutions and applied to the affected part.

CATAPLASMA CARBONIS.—CHARCOAL POULTICE.

Synonym: *Charcoal cataplasm.*

Preparation.—Macerate bread, 2 ounces, with water, 10 fluid ounces, for a short time near the fire; then gradually add and mix with it powdered flaxseed, 10 drachms, stirring so as to make a soft cataplasm. With this mix powdered charcoal 2 drachms, and when prepared for application, sprinkle 1 drachm of charcoal on the surface of the cataplasm (*Lond.*).

The *British Pharmacopœia* differs merely in directing 2½ ounces of linseed-meal, and in employing ½ ounce of wood charcoal.

Action and Medical Uses.—Charcoal, properly prepared, has the property of removing the fetid odor evolved by *gangrenous* and *phagedenic ulcers*, for which the above cataplasm is designed. It should be renewed 2 or 3 times in every 24 hours.

CATAPLASMA CONII.—HEMLOCK POULTICE.

SYNONYMS: *Hemlock cataplasm, Conium cataplasm.*

Preparation.—This poultice is official in the *British Pharmacopœia*, and is prepared as follows: One fluid ounce of hemlock juice is evaporated to ½ fluid ounce, and this is added to a mixture of 4 ounces of linseed-meal in 10 ounces of boiling water, and the whole stirred together. Conium extract may be substituted for hemlock juice if so desired, though the juice only is directed by the above-mentioned authority.

Action and Medical Uses.—This poultice is desirable when a preparation of this class is needed with pain-relieving properties. It has been employed in *malignant sores*, being especially valuable in *cancer*.

CATAPLASMA DAUCI.—CARROT POULTICE.

SYNONYMS: *Cataplasma carotæ, Carrot cataplasm.*

Preparation.—Take of garden carrots, scraped, 4 ounces, Indian meal, 1 ounce, boiling water, a sufficient quantity to form a cataplasm of the proper consistence.

Action and Medical Uses.—This will be found a valuable application to *indolent* and *gangrenous ulcers*, and *painful tumors*.

CATAPLASMA FERMENTI.—YEAST POULTICE.

SYNONYM: *Yeast cataplasm.*

Preparation.—To ½ pint of milk, tepid, add yeast, 2 fluid ounces, and fine slippery-elm bark, a sufficient quantity to form a cataplasm of the proper consistence (Beach's *American Practice*).

The *British Pharmacopœia* directs that 6 fluid ounces of beer yeast be mixed with 6 fluid ounces of water (at 37.7° C. [100° F.]), after which 14 ounces of wheat flour is stirred into the yeast mixture, and the mixture placed near the fire until fermentation ensues, causing it to rise through the liberation of carbon dioxide.

Action and Medical Uses.—This is valuable as an antiseptic application. It will be found especially serviceable in *gangrenous* and *phagedenic ulcerations;* it destroys the fetor, often checks the sloughing, and assists the separation of the dead parts. It should be renewed 2 or 3 times a day. Five or 10 drops of carbolic acid stirred in this poultice, will augment its antiseptic virtues.

CATAPLASMA LINI.—LINSEED POULTICE.

SYNONYMS: *Flaxseed poultice, Linseed cataplasm, Flaxseed cataplasm, Cataplasma emolliens, Cataplasma communis.*

Preparation.—To boiling water, 10 fluid ounces, add gradually, powdered flaxseed, 4½ ounces, or a sufficient quantity; stir constantly, so as to make a cataplasm (*Lond.*).

The *British Pharmacopœia* directs 4 ounces of linseed-meal. If American "*cake-meal*" be employed, the addition of about ½ ounce of olive oil will be necessary. Some prefer a mixture of linseed-meal and cake-meal for this purpose.

Action and Medical Uses.—This is a valuable emollient cataplasm, to allay *pain*, *inflammation* and favor *suppuration*. It is used for similar purposes with the elm poultice. If it should decompose, as it is apt to do, it may vesicate, or at least cause a pustular eruption, sweet oil, lard, glycerin, or olive oil may be mixed with or spread upon the poultice, both as a preservative and preventive. Flaxseed poultice causes the skin to be blanched, sodden, and wrinkled. Flaxseed poultice is frequently employed in *acute pulmonic disorders*.

CATAPLASMA LOBELIÆ.—LOBELIA POULTICE.

SYNONYM: *Lobelia cataplasm*.

Preparation.—To equal parts by weight of powdered lobelia and fine elm bark, add a sufficient quantity of weak lye, warm. to form a cataplasm.

Action and Medical Uses.—This forms an excellent application to *felons*, *white-swelling*, *wounds*, *fistula*, *inflammation of the breast* and other parts, *stings of insects*, *erysipelatous inflammations*, and *painful swellings* or *ulcerations*. It should be frequently renewed.

CATAPLASMA OXYCOCCI.—CRANBERRY POULTICE.

SYNONYM: *Cranberry cataplasm*.

Preparation.—Take of ripe cranberries, *any quantity*, and bruise them to form a cataplasm.

Action and Medical Uses.—Applied around the throat in *quinsy*, and in swelling of the glands of the throat in *scarlatina* and other diseases, its action is prompt. It has been likewise reputed useful in *cancerous ulcers*, *erysipelatous inflammation*, and *gouty rheumatism*. A split cranberry, secured in position by a daub of starch, is recommended for *boils* on the tip of the nose, when a poultice can not be retained in place.

CATAPLASMA PHYTOLACCÆ.—POKE-ROOT POULTICE.

SYNONYMS: *Phytolacca poultice*, *Poke-root cataplasm*.

Preparation.—Place fresh poke-root in hot ashes to roast, when sufficiently done, mash it and form a cataplasm.

Action and Medical Uses.—This may be applied to all kinds of *tumors* in order to discuss them; or if they be too far advanced, it will hasten suppuration. In the latter instance its action is accompanied with much pain. It is applicable when it is desired to hasten suppuration in *mastitis*. It is especially valuable in tumors of an indolent character, as *buboes*. It should be renewed 2 or 3 times a day.

CATAPLASMA SINAPIS.—MUSTARD POULTICE.

SYNONYMS: *Sinapismus*, *Sinapism*, *Mustard cataplasm*, *Cataplasma rubefaciens*.

Preparation.—The *British Pharmacopœia* directs 2½ ounces of mustard (composed of both ground white and black mustard) to be mixed with 2 or 3 ounces of water (luke warm). This is to be stirred into a mixture of 2½ ounces of linseed-meal, made with boiling water (6 or 8 ounces). Mustard should not be mixed with hot water, and it is altogether probable that, by mixing the above mixture of flaxseed and *boiling water*, the poultice is rendered less effective on account of the volatilization of a portion of the volatile oil of the mustard. The *French Codex* simply directs the preparation of 200 Gm. [7 oz. av., 24 grs.] of black mustard-meal, recently prepared, to be mixed with water (scarcely tepid) until a poultice-consistence is obtained. A simple method is to mix flour, or flaxseed, with ground mustard, and mix with sufficient water to form a poultice. Vinegar should not be employed in making mustard poultices.

Action and Medical Uses.—Mustard poultice is powerfully stimulant to the skin, the rubefacient effect being quickly produced, and, if long applied, vesication may ensue. A mustard plaster produces intolerable burning. Gangrenous ulcerations have been produced by the careless and prolonged application of these poultices. The black mustard is stronger than the white, and, as a rule, the former should not be left in contact with the skin longer than 20, nor the latter longer than 30 minutes. Care should be exercised in applying them to children. It is best to have a thin piece of gauze or other fabric between the surface of the poultice and the skin, the hairs of the latter having been previously shaved off. (For *Uses*, see *Sinapis*. For *Mustard plaster*, see *Charta Sinapis*).

CATAPLASMA SODÆ CHLORINATA.—CHLORINE POULTICE.

SYNONYMS: *Chlorine cataplasm, Chlorinated soda poultice.*

Preparation.—Gradually mix 4 ounces of linseed-meal with 8 fluid ounces of boiling water, and add to the mixture, with constant stirring, 2 fluid ounces of solution of chlorinated soda (Labarraque's solution).

Action and Medical Uses.—This poultice is official in the *British Pharmacopœia*, and may be employed where yeast poultice is indicated. It has a stimulant action on old *sloughing ulcerations*, and corrects the fetid emanations arising therefrom.

CATAPLASMA STRAMONII.—STRAMONIUM POULTICE.

SYNONYM: *Stramonium cataplasm.*

Preparation.—Take of the fresh leaves of stramonium, *any quantity*, bruise them, and add a small quantity of hot water, to form a sufficiently moist cataplasm.

Action and Medical Uses.—I have found this a decidedly efficient application in *peritoneal inflammation*, the whole abdomen to be covered with it; likewise in *acute rheumatism*, and in *gastro-intestinal inflammations*. Applied to the perineum in *enlargement of the prostate*, for the purpose of securing the passage of the catheter in case of retention of urine, when it can not otherwise be entered into the bladder, I know of no better agent—it should remain on the parts about an hour before attempting the introduction of the catheter. It will be found valuable in *rheumatic* or *neuralgic pains* (Prof. J. King, M. D.).

CATAPLASMA ULMI.—ELM POULTICE.

SYNONYMS: *Elm cataplasm, Slippery-elm poultice.*

Preparation.—Take of powdered elm bark (*Ulmus fulva*) a *sufficient quantity;* stir it in hot water, or milk and water, to the consistence of a cataplasm (Beach's *American Practice*).

Action and Medical Uses.—This cataplasm is of almost universal application, and is superior, in many respects, to every other. As an application to *painful swellings, inflammations, ulcerations*, and to facilitate the separation of the slough produced by caustics, and for various other purposes, it stands, and justly, too, in high repute among American physicians.

Other Cataplasms.—I. BREAD POULTICE.—Take crumbs of bread, *any amount*, and heat with sufficient sweet milk to form a cataplasm. A little fresh lard may be added, which prevents the skin from becoming sodden and wrinkled. It forms a good emollient poultice, but should be frequently renewed.

II. MOLASSES POULTICE.—New Orleans molasses, a *sufficient quantity*, add wheat flour, enough to form a soft, easily-spreading mass. This is, according to Prof. J. U. Lloyd, one of the very best applications for *burns* and *scalds*, and his standard laboratory application, where scalds are not infrequent. It should be spread upon a cloth and the burned surface bound up in it.

III. INDIAN-MEAL POULTICE.—Corn-meal, a *sufficient quantity*. Stir gradually into boiling water until of the desired consistence. An excellent emollient application. In the form of a mush-jacket, it is much employed in *acute pulmonary* and *pleural inflammations*. When prepared with a hot decoction of black-willow bark (*Salix nigra*), it forms an excellent application to surfaces *poisoned by Rhus Toxicodendron* and other species of poison vine.

IV. Potato Poultice.—Mashed boiled potatoes spread upon *inflamed surfaces* are often useful, being peculiarly effective in *acute arthritic rheumatism*. *Grated raw potato* is also a useful application for *inflammatory disorders*, and especially valuable in *inflammations of the face* and *eyelids*. It will stain clothing black.

V. Alum Poultice.—This is prepared by coagulating with 1 drachm of alum, the albumen, or fluid whites, of 2 eggs. It is employed where a cooling and astringent cataplasm is required.

CATARIA.—CATNIP.

The leaves and flowering tops of *Nepeta Cataria*, Linné (*Cataria vulgaris*, Mœnch).

Nat. Ord.—Labiatæ.

Common Names and Synonyms: *Catnip, Catmint, Catnep; Herba nepetæ, Herba catariæ.*

Illustration: Bentley and Trimen, *Med. Plants*, 209.

Botanical Source and Description.—Catnip or catmint is a perennial herb, with an erect, square, hoary-tomentose, branching stem, 2 or 3 feet in height. The leaves are opposite, cordate, oblong, petiolate, coarsely crenate-serrate, and covered with a soft, hoary down, paler beneath. The flowers are many, white, or purplish, in whorled spikes, which are slightly pedunculated, the lower lip dotted with crimson. The calyx is dry, striate, tubular, obliquely 5-toothed. The corolla is naked and dilated in the throat, 2-lipped, twice the length of the calyx; upper lip rather concave, erect, notched, or 2-cleft; lower spreading, 3-cleft, middle lobe largest and crenate. The stamens are 4, ascending under the upper lip; anthers approximate in pairs, the cells divergent (G.—W.).

History.—Catnip is a very common, naturalized plant, growing about old buildings and fences, and on waste and cultivated lands, flowering from June to September. It is a native of Europe. The tops and leaves are medicinal; they have a strong, characteristic odor, not very grateful to many persons, and a peculiar, bitterish taste. Their virtues are imparted to boiling water by infusion. It is very much liked by cats, preventing, it is said, attacks of fits.

Catnip should be collected each year in June and July, when flowering, and the coarser stems and branches rejected. It deteriorates in value, hence the necessity of gathering it annually. A variety, *Nepeta Cataria*, Linné, var. *citriodora*, Becker, has the odor of lemon or balm.

Chemical Composition.—Its active constituents are an oxygenated essential oil, and tannic acid striking a green color with ferruginous salts. Mr. H. R. Gillespie, in 1889, detected in catnip both fixed and volatile oils, mucilage, sugar, dextrin, a crystallizable wax, and a bitter body, neither glucosidal nor alkaloidal in character, but having acid properties.

Action, Medical Uses, and Dosage.—Catnip is diaphoretic and carminative in warm infusion; tonic when cold. It is also antispasmodic, emmenagogue, and diuretic. In warm infusion it is used in *febrile diseases* as a diaphoretic, and to to promote the action of other diaphoretics, as well as to allay spasmodic action and produce sleep; it is also given as a carminative and antispasmodic in the *flatulent colic* of children; and as an emmenagogue or uterine tonic, it has proved decidedly beneficial in *amenorrhœa* and *dysmenorrhœa*, and has likewise been successfully employed in *nervous headache*, *hysteria*, and *nervous irritability*. The leaves are reputed beneficial in *toothache*, when masticated and applied to the decayed tooth. A warm infusion of saffron and catnip is a very popular and beneficial remedy in *colds*, *febrile* and *exanthematous diseases* to which infants and young children are subject. The infusion is very efficient in allaying the *irritability* and *nervousness of dyspeptics*. A fluid extract of catnip, valerian, and scullcap forms an excellent agent for the cure of *nervous headache*, restlessness, and many other nervous symptoms. The expressed juice of the herb, given in doses of a tablespoonful 2 or 3 times a day, is decidedly a superior remedy in *amenorrhœa*, often restoring the menstrual secretion after other means have failed. The leaves are frequently used in fomentation as a local application to *painful* and *inflammatory affections*. Of the dried leaves in powder, 2 drachms may be given for a dose in some liquid, as cold or warm water; the infuion (1 ounce of the recently dried herb to 1 pint of boiling water) may be drunk warm as freely as the stomach will permit. Specific nepeta cataria, 2 to 60 drops.

Specific Indications and Uses.—Abdominal pain, with constant flexing of the thighs, writhing, and persistent crying; colic. A remedy for children.

CATECHU (U. S. P.)—CATECHU.

"An extract prepared from the wood of *Acacia Catechu* (Linné filius) Willdenow"—(*U. S. P.*). (*Mimosa Catechu*).

Nat. Ord.—Leguminosæ.

Common Names: *Catechu*, *Black catechu*, *Cutch.*

Illustration: Bentley and Trimen, *Med. Plants*, 95.

Botanical Source.—Acacia Catechu is a small-sized tree, from 15 to 20 feet high. The bark is thick, scabrous, rust-colored, slightly bitter, and exceedingly astringent; the branches are spreading, armed with strong, black, stipulary spines, and downy toward their extremities. The leaves are bipinnate; pinnæ 10 to 30 pairs; leaflets 30 to 50 pairs, linear, bluntish, unequal, and auricled on the lower side of the base, and ciliated; the petiole angular, and channeled above, downy, with 1 orbicular urceolate green gland below the lowest pair, smaller ones between the two, and has 3 or 4 terminal pairs of pinnæ. The spikes are axillary, 1 or 2 together, slender, cylindrical, and borne on downy stalks. The flowers are numerous, white or pale-yellow, and sessile. The calyx is downy, tubular, and 5-toothed; the teeth erect. Corolla rather longer than the calyx, 5-petaled, and glabrous. Stamens twice the length of the corolla, very numerous and distinct; anthers roundish. The ovary is green, glabrous, and shortly stipitate; the style capillary, and as long as the stamens; stigma simple. The legumes are flat, linear, thin, straight, glabrous, and contain about 6 orbicular, compressed seeds (L.).

History.—The catechu tree is common to the East Indian continent, thriving in Bengal, on the Coromandel and Malabar coasts, etc., and, according to Pereira, in Jamaica. According to Dr. Royle, the extract (catechu), is prepared by concentrating a strong aqueous decoction of the reddish inner wood, and pouring it into square clay molds to dry. Catechu is likewise obtained from the *Areca Catechu* (see *Areca*), and *Uncaria Gambier* (see below). There are several kinds of it met with in commerce, but the best are those which are the most astringent. It was named *Terra japonica* at a time when its source was unknown, the general belief being that it came from Japan.

Description and Tests.—Catechu is met with in square, round, and irregular pieces, pale-red, pale-brown, dark-brown, or blackish in color, friable, odorless, astringent, and sometimes having a sweetish after-taste. The specific gravity of catechu is 1.28 to 1.39. It is soluble in hot water, which takes up its tannic and catechuic acids, but a reddish matter is deposited as the solution cools. It is imperfectly soluble in cold water. The tannic acid of catechu is easily soluble in water and alcohol, but very slightly so in ether. Alcohol or ether dissolves its catechuic acid. Its solutions are not precipitated by alkalies. The official catechu is described as occurring "in irregular masses, containing fragments of leaves, dark-brown, brittle, somewhat porous and glossy when freshly broken. It is nearly inodorous, and has a strongly astringent and sweetish taste. If a portion of catechu be digested with 10 times it weight of alcohol, and the liquid filtered, the undissolved matter, after being dried at 100° C. (212° F.), should not exceed 15 per cent of the original weight. The tincture, diluted with 100 parts of water, acquires a green color on the addition of ferric chloride T.S. If 2 parts of catechu be boiled with 20 parts of water, a brownish-red, turbid liquid will be obtained which turns blue litmus paper red. Upon incineration, catechu should not leave more than 6 per cent of ash"—(*U. S. P.*). Catechu is incompatible with solutions of the pure earths, with sulphuric or hydrochloric acid, salts of aluminum, lead, copper, and with ferric salts; also with gelatin, opium, cinchona, and those salts of the vegetable alkaloids which form insoluble salts with tannin.

Chemical Composition.—Successive treatment of catechu with ether and absolute alcohol abstracts the two principal constituents, namely, from 13 to 33 per cent of crude *catechin*, also called *catechuic acid*, and from 22 to 50 per cent of a peculiar tannic acid, called *catechu-tannic acid*. Besides there are present water-soluble extractive matter, gum, and mineral substances. *Catechin* is not soluble in cold water. When pure, it forms minute, colorless crystals, which are acted on by alkalies, causing them to absorb oxygen, giving a yellow, then red, and finally a black color. Its formula is variously given as $C_{19}H_{18}O_8$ (Hlasiwetz), $C_{21}H_{18}O_8$ (Gautier), $C_{17}H_{12}O_6$ (Rochleder), $C_{21}H_{20}O_9+5H_2O$ (Liebermann and Tauchert). When subjected to dry distillation, it yields *pyrocatechin* ($C_6H_6O_2$), while *phloroglucin* and *protocatechuic acid* are produced by fusing it with caustic potash. By the action of sulphuric acid, *catechuretin* is produced.

The *catechu-tannic* acid of catechu, sometimes termed *mimmotannic acid* and *catechu-red*, differs from ordinary tannic acid by giving a greenish-gray precipitate with the iron salts, by not precipitating a solution of tartar emetic, and by not furnishing pyrogallic acid on exposure to heat. It is an amorphous, deep-red powder, dissolving in alcohol, alcoholized ether, and water, but little soluble in absolute ether, and is regarded as an anhydrid of catechin.

Quercetin was obtained from the aqueous solution of catechu by means of ether, by Löwe, in 1873.

Pyrocatechin ($C_6H_6O_2$), or *catechol*, may be obtained from many tannins and extracts by means of destructive distillation. It forms short, prismatic crystals, readily soluble in water, ether, and alcohol. Ferric chloride colors its solution in water a deep green, which, when treated with sodium bicarbonate, ammonia, or tartaric acid, changes to a violet hue. Catechol fuses at 104° C. (219.2° F.). Its boiling point is 245° C. (473° F.). Its methylic ether is *guaiacol*. Certain gum-resins, resins, and tannins, when fused with caustic potash, produce *protocatechuic acid* ($C_7H_6O_4$) (dioxybenzoic acid). It forms shining, acicular crystals, or may form scales, readily soluble in hot water, alcohol, and ether. When heated above 199° C. (390.2° F.) it is resolved into *pyrocatechin* and carbonic acid gas. When treated with ferric chloride its aqueous solution gives a deep-green color, changing successively to blue and red by sal soda solution much diluted.

Action, Medical Uses, and Dosage.—Catechu possesses strong astringent properties. It is used for arresting *mucous discharges* when excessive, for removing relaxation or congestion of mucous membranes, and for checking *hemorrhages*. In *chronic diarrhœa*, *chronic catarrh*, *colliquative diarrhœa*, and *chronic dysentery*, it has proved beneficial, especially when combined with opium. As a local application, it is a valuable agent for removing *cynanche tonsillaris*, *aphthous ulcerations of the mouth*, *elongation of the uvula*, and *relaxation* and *congestion of the mucous membrane of the fauces*, especially of the kind to which public singers are subject; it is also useful in *congestion*, *tenderness* and *sponginess of the gums*, particularly when the result of *mercurial ptyalism*. The tincture of catechu is often beneficial in *fissure of the nipples*, when applied twice a day with a fine hair pencil. An ointment composed of 4 ounces of catechu, 9 drachms of alum, 4 ounces of white resin, and 10 fluid ounces of olive oil, with a sufficient quantity of water, is in great repute in India as an application to *ulcers* (Thomson, *Lond. Dis.*). *Chronic* and *phagedenic ulcers* are frequently benefited by the application of catechu to them. *Chronic gonorrhœa*, *old gleets*, and *fluor albus*, as well as *hemorrhage* from the nose and other parts, have been cured by the local application of an aqueous solution of catechu. Powdered catechu may be given in a dose of from 5 to 20 grains, or more, repeated as often as required; it may be administered in pill form, in syrup, or in gum mucilage. The dose of the tincture is from 20 minims to ½ fluid ounce. Dr. E. Hopkins states that catechu is not incompatible with opium and quinine, as no precipitate ensues when their respective solutions are united. He recommends, in *diarrhœa*, a compound of catechu 10 grains, opium 1 grain, sulphate of quinine 2 grains; mix, and make into 1 or 2 powders, according to the urgency of the case. CATECHU PALLIDUM (see below), has similar properties, but is less astringent.

Related Drugs.—CATECHU PALLIDUM. *Pale catechu* (*Catechu* of *Br. Ph.*).—This is also known as *Terra Japonica*, *Gambir*, *Gambier*, and *Gambeer*. Pale catechu is the official catechu of the *British Pharmacopœia*, and one of the official kinds of the *German Pharmacopœia*. It is extracted from the young leaves and shoots of *Uncaria Gambier*, Roxburgh (*Nauclea Gambir*, Hunter). *Nat. Ord.*: Rubiaceæ. This is a climbing plant bearing pink flowers, and grows in Sumatra, Ceylon, and in the countries bordering the straits of Malacca. At Singapore it is extensively cultivated. A species thought to be a variety, *Uncaria acida*, Roxburgh, also furnishes a portion of pale catechu. Gambier is prepared by boiling the fresh young twigs and leaves for 1 hour, after which they are taken out and placed in a trough which allows the decoction to flow back into the boiling pan, and the liquor from the exhausted shoots and leaves is squeezed out by hand. The fluid is then evaporated to a thin, syrupy consistence, and dipped into vessels to cool, and instead of stirring round and round, the operator passes a soft piece of wood in and out of the liquid, in a sloping manner. This, he asserts, will cause it to thicken when ordinary stirring will have no effect on it. It is then poured into shallow, rectangular molds, and allowed to harden sufficiently to be cut into cubical blocks to be dried in a shady situation (see *Pharmacographia*). Gambier is an earthy-appearing mass of pale-brown color. It occurs in small cubes, or may come in irregular, compact masses. It is lighter in color than cutch, which it resembles, and when broken (for it is porous, dry, and friable), it presents an irregular surface of an earthy, brownish-gray hue, interspersed with darker streaks. It is odorless, but has a bitter, astringent, and afterwards sweetish taste. The microscope shows it to be made up of minute, crystalline needles. It dissolves in alcohol, giving a deep-brown solution. Water does not dissolve it wholly, and with hot water a turbid mixture is produced. Impurities to the extent of 15 per cent of the whole weight are allowed by the *German Pharmacopœia.* The same work limits its ash to not more than 6 per cent. Its chemical composition agrees with that of cutch (catechu), the proportion of tannin being less than in the latter. The coloring principle is *quercetin* and the chief constituent is *catechin*, which gives to it a crystalline appearance. *Quinovic acid* is probably present in gambir, having been found in other species of *Nauclea*. It contains from 25 to 38 per cent of tannin, and from 20 to 29 per cent of catechin. The ash consists largely of calcium and magnesium carbonates (*Pharmacographia*). Prof. Trimble (*Am. Jour. Pharm.*, 1888) making a comparative determination of catechin, catechu-tannic acid and other constituents in 3 representative samples each, of cutch and of gambier, finds a decidedly higher percentage of available tannin in gambier than in cutch. He therefore recommends the official use of gambier in preference to cutch for several reasons: Gambier, as he finds, has more available astringency, and being put up in the form of cubes, can not be so easily adulterated, and is not liable to contain mordants added for the use of dyers.

CAULOPHYLLUM (U. S. P.)—CAULOPHYLLUM.

"The rhizome and roots of *Caulophyllum thalictroides* (Linné), Michaux"—(*U. S. P.*). (*Leontice thalictroides*, Linné).

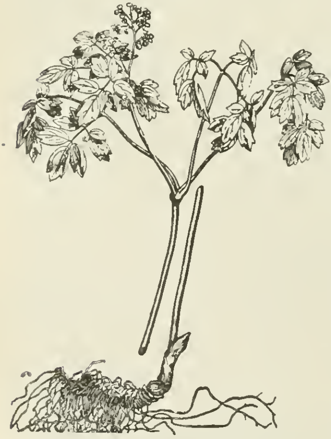
Nat. Ord.—Berberidaceæ.

Common Names: *Blue cohosh*, *Squaw-root*, *Pappoose-root.*

Illustration: Lloyd's *Drugs and Med. of N. A.*, Vol. II.

Botanical Source.—This plant is a smooth, glaucous plant, purple when young, with a high, round stem, from 1 to 3 feet in height, simple from knotted and matted root-stalks, dividing above into 2 parts, 1 of which is a triternate leaf-stalk, the other bears a biternate leaf and a racemose panicle of small, yellowish-green flowers. The leaves are biternate and triternate. The petiole is trifid, supporting 9 leaflets. The leaflets are oval, petiolate, and unequally lobed, the terminal one equally 3-lobed, paler beneath, and from 2 to 3 inches long. The panicle is small, and shorter than the leaves. The pericarps are thin, caducous, dark-blue, and resemble berries on thick stipes. Seeds 1 or 2, erect, globose, about the size of a large pea (W.—G.).

Fig. 62.



Caulophyllum thalictroides.

History.—This drug is one of our oldest indigenous Eclectic remedies. The Algonkin name (*cohosh*) is generally supposed to have been applied to this plant by the natives, but according to the statement of Mr. W. R. Gerard, this is hardly probable, as the native term, "applied by the whites to several plants, smooth in all their parts, means 'it is rough' (with hairs)." Among the Montagnais of Canada the name cohosh is applied to the bristly fruit of *Ribes lacustre.* (See *D. & M. of N. A.*). Still, there is no doubt that the plant was later known to the American Indians, in common with *Cimicifuga racemosa*, *Actæa alba*, and *Actæa rubra var. spicata*, as cohosh. The true common name of the plant is *blue cohosh*, though it is known also in various parts of the country as *pappoose-root* (Smith), *squaw-root* (Smith), *false cohosh* (Eaton), and *blueberry*. Both Pursh (1814) and Barton (1818) call it cohosh, and state that it was known as such among the natives. The plant was introduced into medicine as blue cohosh by Rafinesque, in 1828, though it is but just to say that the Indian uses of the plant were first made known through an irregular publication entitled "*Medical Facts*," issued in Cincinnati, in 1813, by Peter Smith, an advertising "Indian herb doctor;" and, it is to Smith that Rafinesque refers as an authority on the subject. The first published botanical record of the blue cohosh is by Gronovius (1739), who received the plant from Clayton, a Virginian botanist, and the second by Cadwallader Colden (1743), an American botanist, afterward distinguished as governor of New York State. Its present botanical name (*Caulophyllum*) was given it in 1803 by the elder Michaux, who believed the genus to differ sufficiently from the European *Leontice*, with which it had been classed, to entitle it to a generic rank of which only the one species is now known, which is a native of America, and is found also in Japan. The term *Caulophyllum* is derived from two Greek words—*kaulos*, stem; and *phullon*, leaf; hence, stem-leaf, so called because the leaves terminate in such a manner as to give them the appearance of being a mere continuation of the stem. Blue cohosh is widely distributed throughout this country extending from New Brunswick to the southern limits of the Appalachian system of mountains, and westward to the Mississippi valley. Contrary to published statements it is not found in low, moist grounds, swamps and marshes, along sea-coasts and on prairie lands and irrigated islands, but grows in rich, shady woods, and deep loam, in hilly and mountainous districts. It is plentiful along the Alleghany mountains, but it is not found in the adjacent lowlands in the southern states. Caulophyllum is a handsome plant of a peculiar bluish-green color. It blossoms in April and May and matures its fruit in August. A decoction of the roasted ripened seeds is said to resemble coffee. Although caulophyllum was first introduced by Peter Smith as early as 1813 and endorsed by Rafinesque (1828) and the botanics, there was but little call for it, except in domestic medicine for making infusions and decoctions, until 1852, when Prof. King, who first became acquainted with the drug in 1836, brought it out in his first edition of the *American Dispensatory*, giving a description of it and its uses, and introducing some preparations of it. From that time until the present day it has been in increasing demand in Eclectic practice, and has been adopted by the Homœopaths, though it is still largely ignored by the "regulars." Prof. E. M. Hale, M. D., of Chicago, states that caulophyllum was introduced to the Homœopaths by Prof. B. L. Hill, at one time Professor of Surgery in the Eclectic Medical Institute, of Cincinnati, O., in his lectures on obstetrics and gynecology before the Homœopathic College, at Cleveland, O. At the same time he introduced to them hydrastis, cimicifuga and other Eclectic drugs. Among the early preparations of this drug were the fluid extract of caulophyllum, compound tincture of caulophyllum, and the compound tincture of mitchella (mother's cordial), all exclusively Eclectic products. Blue cohosh partially yields its virtues to hot water and glycerin, and fully to alcohol. It may be employed in decoction, or the specific caulophyllum, which is reliable and more convenient, may be used. In purchasing, care must be taken that this root is not mixed with other roots, especially those of the Hydrastis canadensis, with which the pressed and wrapped article prepared for sale is apt to be associated. *Caulophyllin* added to drastic purgatives, as aloes, podophyllin, etc., will entirely prevent or relieve the tormina attending their action.

Description.—"Rhizome of horizontal growth, about 10 Cm. (4 inches) long, and about 6 to 10 Mm. ($\frac{1}{4}$ to $\frac{2}{5}$ inch) thick, bent; on the upper side with broad, concave stem-scars, and short, knotty branches; externally grayish-brown, internally whitish, tough and woody. Roots numerous, matted, about 10 Cm. (4 inches) long, and 1 Mm. ($\frac{1}{25}$ inch) thick, rather tough, nearly inodorous; taste sweetish, slightly bitter and somewhat acrid"—(*U. S. P.*).

Chemical Composition.—The most detailed chemical analysis to date of caulophyllum was made, in 1864, by Mr. A. E. Ebert. He found it to contain albumin, starch, gum, coloring matters, calcium phosphate and sulphate, salts of iron, potassium and magnesium, phosphoric acid, silica, and 2 resins, one soluble in alcohol and ether, and the other not soluble in ether, and "a substance similar to *saponin*." The latter substance was, in 1863, identified and called *saponin* by Prof. F. F. Mayer, who claims also to have obtained a colorless alkaloid. This alkaloid Mr. Ebert failed to find, and inferred that Prof. Mayer's analysis was made with a drug adulterated with hydrastis, or some other alkaloid-yielding plants. He found also that the only substance of interest was the resinous, saponin-like body. Prof. J. U. Lloyd agrees with him in the main as to his analysis and especially with the latter's statement that the "substance similar to saponin" was the characteristic principle of the plant. This amorphous substance found by Mr. Ebert was at first sweetish, and then acrid to the taste, and irritated the nostrils, provoking sneezing. It was soluble in alcohol, both strong and dilute, and in alkaline aqueous fluids. It remained, however, for Prof. Lloyd to obtain this characteristic principle in a pure, crystalline form, for the white amorphous precipitate found by Mr. Ebert contained much foreign matter that was entirely eliminated, in Prof. Lloyd's experiments, by repeated crystallization. To this principle, which, by the way, is a glucosid, Prof. Lloyd applied the name *leontin*—a name derived from the old Greek botanical name *Leontice* (lion's foot), applied to the genus (caulophyllum) by Linnæus. This name, *leontin*, was given to it because the name *caulophyllin*, which could most appropriately be given it, had been applied already to the resinoid of caulophyllum.

Leontin, as obtained by Prof. Lloyd's process, is a glucosid, occurring in pure, snow-white, feathery, or silky crystals, resembling quinine. It is slightly soluble in cold alcohol, very soluble in boiling alcohol, from which it crystallizes upon cooling. It is slightly soluble in anhydrous alcohol, very soluble in boiling anhydrous alcohol, from which it also crystallizes upon cooling, the most perfect crystals being obtained from absolute alcohol. In sulphuric acid, both cold and boiling, its solubility is similar to that in alcohol. In chloroform it is practically insoluble. It is insoluble in water, and upon the addition of water to the alcoholic solution, immediate precipitation is the result. Acids precipitate it and alter its character, while alkaline aqueous solutions dissolve it freely and perfectly. *Leontin* is tasteless, but owing to the alkalinity of the saliva, it slowly dissolves, producing an acrid after-taste. Alcoholic solutions of it are acrid to the taste, while the alkaline aqueous solution is extremely acrid and irritating to the mouth and fauces, and for this reason should be administered in syrup, or in sweetened water, which somewhat obtunds these sensations. While odorless, the dust is acrid, producing irritation of the nostrils. Leontin, even in dilute solution, forms much froth when shaken. Prof. Lloyd has further shown that while Prof. Mayer did not obtain an alkaloid from caulophyllum, (which he claims to have done and named *caulophylline*), such an alkaloid does exist, and that he (Lloyd) has separated it as an amorphous, glassy substance, colorless, tasteless, and odorless, freely soluble in alcohol, and quite soluble in water. It does not possess the characteristics of caulophyllum, nor does it have any sensible properties. The name *caulophylline* applied by Mayer must not be confounded with that of the resinoid, *caulophyllin*.

Shortly after 1835, when Prof. John King discovered podophyllin, macrotin, hydrastin, etc., he also brought forth the substance now known in commerce as *caulophyllin*. It was in great demand among Eclectics in times past, and is still sold in considerable quantities. But like nearly all of the so-called concentrations and resinoids of early Eclectic preparation, while they were better agents than preceding pharmacal products, yet at the present time they are too uncertain in composition and medicinal value, to hold a leading place among our more modern therapeutic preparations. The current statement in medical publications that *caulophyllin* is obtained by precipitation from a strong alcoholic tincture with water is, according to Prof. Lloyd, erroneous, as there is no evidence from manufacturers to support it. As prepared by Lloyd, whose process is given in "*Drugs and Medicines of North America*," caulophyllin is a powder of a grayish or brown color, and possesses the characteristic taste of the crude drug. The preparation known as *Lloyd's Leontin*, is a one per cent solution of the white crystalline emmenagogue principle above described.

Action, Medical Uses, and Dosage.—Of caulophyllum, Rafinesque states that "as a powerful emmenagogue it promotes delivery, menstruation, and dropsical discharges." and that "it was employed by the Indians and their imitators for *rheumatism, dropsy, colic, sore throat, cramp, hiccough, epilepsy, hysterics, inflammation of the uterus*, etc." Prof. King first employed blue cohosh for its beneficial influence on abnormities of the mucous tissues, using it for *aphthous stomatitis* in decoction, alone or combined with hydrastis. Prof. Scudder believed that this agent exerted its influence through the hypogastric plexus, thus affecting the circulation, nutrition, and functions of the reproductive apparatus.

Blue cohosh is reputed antispasmodic, emmenagogue, and parturifacient, besides being diuretic, diaphoretic, and expectorant. Its use as a parturient originated in the custom of the Indian squaws of employing a decoction of the root for 2 or 3 weeks previous to labor to facilitate *child-birth*. This became known to the whites through Smith's publication. There is no doubt but that caulophyllum has a decided action upon the gravid uterus. During labor it relieves *false pains* and coördinates muscular contractions, at the same time increasing their power. Like macrotys, it is a better oxytocic than ergot. Unlike the latter agent it stimulates normal contraction instead of inducing spasmodic uterine action. It is most valuable in those cases where delay is due to debility, fatigue, or lack of uterine nervous energy, and for deficient contractions where the tissues feel full, as if congested. As a *partus præparator*, blue cohosh has enjoyed a well-merited reputation. When used by delicate women, or those who experience prolonged and painful labors, for several weeks previous to confinement, it gives tone and vigor to all the parts engaged in the accouchement, facilitating its progress, and relieving much suffering. Prof. Hale testifies that women who have taken caulophyllum previous to confinement, have overrun their time from 10 to 12 days, but all had very easy labors and made good recoveries. It is a good remedy for *after-pains*, especially when spasmodic in character. Caulophyllin has also been used for this purpose. It is a remedy for *hour-glass contraction* and for *spurious labor-pains*. Blue cohosh acts as an antiabortive by relieving the irritation upon which the trouble depends. King states that for this purpose it is fully equal to viburnum.

As a gynecian remedy it has been employed to relieve *irritation of the reproductive organs* as if dependent on congestion. It controls chronic inflammatory states of these organs and gives tone in cases of debility. In the sexual disorders of the female it is indicated by tenderness and pain in the uterus, in debilitated patients. It has been very successfully used in cases of *hysteria* to overcome the attack, and to relieve *ovarian*, or *mammary pain*, or *irritation* when accompanying that disorder. *Chronic corporeal*, or *cervical endometritis, metritis, ovaritis, ovaralgia, uterine leucorrhœa, amenorrhœa*, and *dysmenorrhœa*, are conditions in which it has been most successfully employed. It has an established reputation as a remedy for *rheumatism of the uterus*, with nervous excitement, for *uterine cramps* attending menstruation, and for *menorrhagia*, depending on *uterine subinvolution*.

As an antispasmodic it has been employed in *chorea* and *epilepsy* due to diseased states of the sexual organs, but with varying results. It is better suited for *spasmodic intestinal affections*, as *flatulent* and *spasmodic colic*, and *cramps*. It is not without value in *obstinate singultus*. Its antispasmodic effects are permanent.

By lessening irritation it has been serviceable in *cystitis, urethritis, chronic nephritis*, and *albuminuria*. *Spasmodic retention of urine* is relieved by it. It is a good remedy for some cases of *rheumatism*, though not so valuable as macrotys. It effectually overcomes rheumatoid conditions of the uterus and of the stomach—in the latter instance when crampy pains follow the ingestion of food. While valuable in all chronic cases of *muscular rheumatism*, it is especially adapted to *articular rheumatism*, particularly when confined to the smaller joints, as of the toes and fingers. It is a remedy for *asthenic plethora*, and for rheumatic pains accompanying that condition. Associated with testicular support, it favorably influences *orchialgia*. By its sedative action it is valuable in some cases of *insomnia*, and has been suggested as a remedy for *bronchitis* and *catarrhal pneumonia*. It is also a remedy for *gastric nausea* and *vomiting*. Dose of the infusion (root ℥j to aqua Oj), from 1 to 3 ounces, every 3 or 4 hours; of specific caulophyllum, from 3 to 10 drops; of caulophyllin, from 2 to 4 grains.

Lloyd's Leontin (the 1 per cent solution of the emmenagogue principle of blue cohosh) has been very successfully employed in *amenorrhœa*, *dysmenorrhœa*, and *chlorosis*. The dose ranges from 5 to 15 drops in syrup or sweetened water.

Specific Indications and Uses.—The specific indications for caulophyllum are uterine pain, with fullness, weight, and pain in the legs; fullness of tissues as if congested; debility (irritability) of the nervous system, with impaired muscular power; spasmodic muscular pains; articular pain; rheumatic pains of asthenic plethora; epigastric and umbilical colicky pains; dull frontal headache; great thirst; as an oxytocic; to relieve false pains and uterine irritability; sexual debility, with excitability; spasmodic uterine contractions; dysmenorrhœa; irregular menstruation; crampy pains in stomach and bowels after eating; pain in toes and fingers not due to tissue changes.

Related Drug.—*Stylosanthes elatior*, Swartz. *Pencil flower.* United States. Reputed of value in relieving *abdominal* and *uterine pains* during *pregnancy*, and is said to be a tonic parturient.

CEANOTHUS.—RED-ROOT.

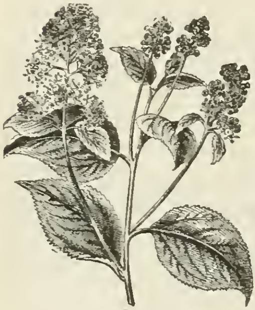
The root root-bark, and leaves of *Ceanothus americanus*, Linné.

Nat. Ord.—Rhamnaceæ.

Common Names: *Red-root*, *New Jersey tea*. *Wild snowball.*

Botanical Source.—This plant has a large root, with a red or brown epidermis, containing many small, white veins, and tolerably thick; body of the root dark-red. The stems are from 2 to 4 feet high, slender, suffruticose, with many reddish, round, smooth branches, the younger ones pubescent. The leaves are ovate or oblong-ovate, acuminate, serrate, 3-veined, rather smooth above, downy, with soft, reddish hairs beneath, and often heart-shaped at base. The flowers are minute, white, in long, crowded panicles from the axils of the upper leaves. Calyx 5-cleft, companulate, cut round after flowering, with the base permanent and adhering to the fruit. Petals 5, saccate-arched, with long, spreading claws. Stamens 5, exserted, inclosed in the curiously vaulted corolla; anthers ovate, 2 celled; ovary, 3-angled. Fruit dry, obtusely triangular, 3-celled, loculicidal, with papery valves; cells 1-seeded; seed convex outside, concave within (G.—W.).

Fig. 63.



Ceanothus americanus.

History.—Ceanothus americanus is indigenous to the United States, and is very abundant in the West; it grows in dry woodlands, barrens, etc., flowering from June to August. The leaves are astringent and slightly bitter, and have been used as a substitute for tea, to which they have a strong resemblance when dried, both in taste and odor. The root is the medicinal part, and has a taste and smell somewhat resembling those of the peach leaf. It has been occasionally used for coloring. Water extracts its active principle.

Description.—Red-root is a long, cylindrical, thick, irregularly contorted, branching root, with either a simple or branched head, with knotty tubercles. Its surface is finely corrugated, and of a rusty-brown color. The bark is thin, and breaks with a granular fracture; the wood, light brownish-red, and tough. To the taste red-root is astringent and bitter, but has no odor.

Chemical Composition.—The leaves are said to contain tannin, a soft resin, a bitter extractive, a greenish coloring matter almost identical in color and taste with green tea, gum, a volatile substance, lignin, and a principle called *ceanothine*, but which does not appear to exert as much therapeutical value as the infusion or fluid extract of the root-bark. When purified, ceanothine is white; its odor and taste is similar to that of green tea; it is soluble in water, but insoluble in alcohol, ether, and carbon disulphide. Chloroform is its best solvent. Clinch (*Amer. Jour. Pharm.*, 1884) found in the leaves a volatile oil. The bark contains considerable tannin and *ceanothine*.

F. C. Gerlach (*Amer. Jour. Pharm.*, 1891) found ceanothus-red, tannin, volatile oil, gallic acid, resin, vegetable wax, fixed oil, starch, saccharose, glucose, mucilage, albuminoids, calcium oxalate, and the alkaloid *ceanothine*, which he found to resemble caffeine in not forming salts, but differing in not being precipitated with Mayer's reagent (*A. P. A. Proc.*, 1892).

Action, Medical Uses, and Dosage.—Astringent, expectorant, sedative, antispasmodic, and antisyphilitic. It is used in *gonorrhœa*, *dysentery*, *asthma*, *chronic bronchitis*, *whooping-cough*, and other *pulmonary affections*. Dose of a strong decoction, 1 tablespoonful 3 or 4 times a day. It has likewise been successfully used as a wash and gargle in the *aphtha* of children, *sore mouth* subsequent to *fever*, and in *ulceration of the fauces* attendant on *scarlatina*.

Besides the old uses, as given above, ceanothus has been found to be a useful gastric, hepatic, and splenic stimulant, and it is in splenic troubles that its action is most favorable. Scudder (*Spec. Med.*), states that it is indicated by *splenic enlargement*, with sallow, doughy skin, and expressionless face. Webster gives as indications, deep-seated splenic pain, though no enlargement be detectable, and for the pain of splenic hypertrophy, as well as for sympathetic, painful conditions depending upon splenic wrong. Its action is compared to that of carduus marianus, influencing the hepatic, and more so the splenic vessels, overcoming congestion. *Hypertrophy of the spleen* and *splenitis* of malarial origin are met with it. The cases of splenitis to which it is specially adapted are not acute, but rather sub-acute, after the active symptoms have passed, and when pressure does not markedly aggravate the pain. It was much used during the Civil War for *malarial splenitis*. Copious *catarrhal profluvia* in non-inflammatory conditions are benefited by its astringency. For hepatic and splenic disorders the tincture of the leaves is preferred. Dose: Strong decoction, fl℥ss 3 times a day; specific ceanothus, 1 to 10 drops.

Specific Indications and Uses.—Enlarged spleen; sallow, doughy skin; expressionless countenance; non-inflammatory, catarrhal states, with profuse secretion.

Related Species.—*Ceanothus ovalis*, Bigelow. United States, Vermont to Rocky Mountains. Has oval leaves, and is probably similar to above species.

Ceanothus reclinatus, De Candolle. Mexico and West Indies. Used by the natives in *gonorrhœa*, *syphilis*, *dysentery*, *ulceration of the mouth and fauces*, and *cancer*.

Ceanothus azureus, Desfontaines, and *Ceanothus cœruleus*, Lagasca. Mexico. Febrifuge.

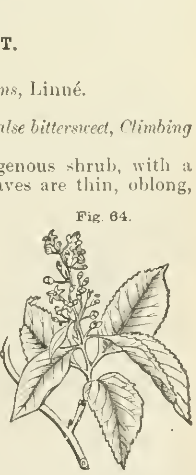
CELASTRUS.—FALSE BITTERSWEET.

The bark of the root and the bark of *Celastrus scandens*, Linné.

Nat. Ord.—Celastraceæ.

Common Names: *Staff-tree*, *Climbing staff-tree*, *Staff-vine*, *False bittersweet*, *Climbing bittersweet*, *Waxwork*, *Fever-twig*.

Fig. 64.



Celastrus scandens.

Botanical Source.—This plant is a climbing, indigenous shrub, with a woody, twining stem, without thorns or prickles. The leaves are thin, oblong, acuminate, serrate, alternate, stipulate, petiolate, and smooth; the racemes small, terminal, and axillary; the flowers are greenish-white, or yellowish-white, fragrant, and diœcious. Calyx flat, 5-lobed; corolla spreading, of 5 sessile petals; capsule obtusely 3-angled, 3-celled, and berry-like; valves bearing the partitions on their centers; stamens standing around a glandular, 5-toothed disk; style thick; stigma 3-cleft. The seeds, which are covered with a scarlet aril, number 1 or 2 in each cell (G.—W.).

History.—This plant grows in woods and thickets, from Canada to the Carolinas, creeping on hedges and rocks, or twining about other trees, or each other, and ascending to a great height. It flowers in June and bears a scarlet berry, which remains through the winter. The plant thrives most luxuriously in a rich, damp soil. The root is very long, creeping, woody, of a bright-orange color, about

½ inch in thickness, with a thick red, or yellowish-red bark, which is the medicinal part. On account of the similarity of name, bittersweet, the plant has been confounded with the *Solanum Dulcamara*, from which, however, it essentially differs in appearance and therapeutic action. The bark has a bitter, afterward sweetish, rather nauseous taste, and imparts its medicinal properties to water.

Description.—The root-bark occurs in nearly smooth quills, orange-brown externally; whitish and marked with fine striæ internally. A second layer of an orange-red hue is exposed on the removal of the somewhat tough outer bark. The stem-bark resembles the above, except that its outer layer has an ashen-gray or brownish-gray color.

Chemical Composition.—Wayne (1872) obtained a white crystalline principle to which the name *celastrin* was given. Bernhard (*Amer. Jour. Pharm.*, 1882) found the bark to contain starch, gum, sugar, coloring material, volatile oil, two resins, one acid and the other neutral, and a body resembling caoutchouc. Mr. Jacob Hoch (1892), failed to find any volatile constituents (*A. P. A.*, 1892). The coloring matter of Celastrus scandens was investigated by Dr. Keller, who defined its chemical relation to the vegetable coloring matters, xanthin and carotin (*Amer. Jour. Pharm.*, 1896).

Action, Medical Uses, and Dosage.—Alterative, diaphoretic, and diuretic, with some narcotic powers. Used in *scrofula*, *secondary syphilis*, *chronic hepatic affections*, *cutaneous affections*, *leucorrhœa*, *rheumatism*, and *obstructed menstruation.* Externally an ointment has been successfully employed in *inflamed* and *indurated breasts* of nurses, in *pruritis vulvæ*, *burns*, *excoriations*, etc. Dose of the decoction, from 2 to 4 fluid ounces, 3 times a day; of the extract, from 5 to 10 grains.

CEPHALANTHUS.—BUTTONBUSH.

The bark of *Cephalanthus occidentalis*, Linné.

Nat. Ord.—Rubiaceæ.

Common Names: *Buttonbush, Buttonwood, Pond dogwood, Crane willow, Globe flower.*

Botanical Source.—This plant is a handsome shrub growing from 6 to 12 feet or more high, the bark being mostly rough on the stem and smooth on the branches. The leaves are opposite or in whorls of 3, oval, acuminate, entire, smooth, spreading, petioled, with short, intervening stipules, and from 3 to 5 inches by 2 to 3. The flowers are white, terminal, in spherical heads about an inch in diameter, resembling the globular inflorescence of the sycamore (*Platanus occidentalis*). Peduncles long; corolla tubular, slender, and 4-cleft; calyx tube inversely pyramidal, the limb 4-toothed; stamens 4; anthers yellow; style threadform, much protruded; stigma capitate, yellow. The fruit consists of small, hard, and dry capsules, inversely pyramidal, 2 to 4-celled, separating from the base upward into 2 or 4 closed 1-seeded portions (G.—W.).

History and Description.—Buttonbush is indigenous to the United States, and is found in damp places, along the margins of rivers, ponds, etc., flowering from June to September. The bark is the part used, and possesses much bitterness. Water or alcohol takes up its virtues. Buttonbush bark occurs in market as short, curved pieces of a smooth, grayish-brown color marked with fine striæ externally. The smooth and white inner bark is tough, and changes to a pale, rusty-brown color. Old bark has sometimes a fissured, ashen-gray, corky layer upon the surface. It has a bitterish, sub-astringent taste, but no odor.

Chemical Composition.—Analysis has shown the bark to contain starch, sugar, gum, fatty matter, several resins, tannin, a saponin-like body, and an amorphous, bitter constituent readily soluble in both water and alcohol. A crystalline, fluorescent body has been obtained by precipitation with acetate and subacetate of lead. These acicular crystals are dissolved by alcohol, ether, and water (Hattan, *Amer. Jour. Pharm.*, Vol. XLV).

Mr. Edo Claasen has obtained three bodies from the bark, *cephalanthin*, *cephaletin*, and *cephalin*. The latter occurs as warty crystals, and is thought to be a glucosid, splitting up into glucose and *cephaletin* on evaporating the solution. *Cephalin* is in yellowish-white needles, strongly-refracting, acid in reaction, and otherwise tasteless. It is insoluble in petroleum ether, very sparingly soluble in cold water, more soluble in hot water, and dissolving with greater ease in alcohol, ether, benzol, chloroform, and acetic acid. This body is strongly fluorescent in aqueous, alcoholic, and alkaline solutions, all well diluted. Even so minute a trace as 1 part in 2,000,000 of water exhibits this property, and if an alkali be added the blue coloration will be noticeable in a dilution of 1 to 20,000,000. The concentrated alkaline solution has a lemon-yellow color (*Proc. A. P. A.*, 1892).

Action, Medical Uses, and Dosage.—Tonic, febrifuge, aperient, and diuretic. The bark has been used with much success in *intermittent* and *remittent fevers;* and the inner bark of the root forms an agreeable bitter, which is often employed in *coughs*, and as a diuretic in *gravel*. The plant deserves further investigation. Tincture, 10 to 30 drops; infusion, f℥ss to f℥i.

Cephalanthin is, according to Kobert (1892), distinctly poisonous to both cold and warm-blooded animals, producing emesis, spasms, and paralysis. It destroys the blood corpuscles, converting them into methæmoglobin and oxyhæmoglobin.

Related Species.—*Sarcocephalus esculentus*, Afzelius. Senegambia and Sierra Leone furnish this plant, which is known in its habitat as the *doundake*. The bark, under the names *Quinquina Africaine* and *Kina du Rio Nunez*, is employed by the negroes as a febrifuge. More properly it is an astringent tonic, and as such is useful in the *anemic state* following *typhoids*, and as a remedy for *loss of appetite*, and for *atonic dyspepsia*. No alkaloid is present, according to Heckel and Schlagdenhauffen, but its virtues seem to depend upon three resinous principles—an orange-yellow bitter soluble in water, alcohol, and solution of potassa; a pale-yellow body insoluble in water, but soluble in potassa solution; and the third insoluble in alcohol and water, but dissolving in the potassa solution.

CERA ALBA (U. S. P.)—WHITE WAX.

"**Yellow wax** bleached"—(*U. S. P.*) (see under *Cera Flava*).

CERA FLAVA (U. S. P.)—YELLOW WAX.

"A peculiar, concrete substance, prepared by *Apis mellifica*, Linné"—(*U. S. P.*).
Class: Insecta. *Order*: Hymenoptera.

Source, History, and Preparation.—Wax is a substance which exists in small quantities in various plants. It is chiefly obtained, however, through the agency of the common bee (*Apis mellifica*), which forms cells, in which its food and ova are contained. It is a natural product of the insect, being secreted upon the abdominal scales or rings. The wax produced by the bee is the official article, of which there are two kinds, yellow wax and white wax.

YELLOW WAX is procured directly from the comb, which, after having been deprived of its honey, is fused in boiling water, strained, again fused, and poured into appropriate vessels of various sizes.

WHITE WAX is prepared by exposing ribbons of yellow wax to air, sunshine, and moisture, for one or two weeks, or more, according to the weather, when it loses its color, nearly all of its odor, and becomes yellowish-white. To bring about this effect, it must be turned every day, and watered from time to time. The wax is then remelted, reribboned, and rebleached; it is subsequently refined by melting in water acidulated with sulphuric acid. When finished, it is cut or cast into flat, round cakes, to which a little spermaceti is generally added to improve the color (C.). Chlorine will also decolorize wax, but changes its character, causing it, when burned, to evolve irritating vapors of hydrochloric acid.

Description and Chemical Composition.—CERA ALBA, *White wax.* "A yellowish-white solid, somewhat translucent in thin layers, having a slightly rancid odor, and an insipid taste. Specific gravity: 0.965 to 0.975 at 15° C. (59° F.). Melting point about 65° C. (149° F.). In other respects white wax has the characteristics of, and should respond to the reactions and tests given under yellow wax (see *Cera Flava*)"—(*U. S. P.*). It readily dissolves in fixed and volatile oils, and combines by fusion with fats and resins; boiled with caustic alkaline solutions, it is imperfectly saponified.

CERA FLAVA.—*Yellow wax.* "A yellowish to brownish-yellow solid, having an agreeable, honey-like odor, and a faint, balsamic taste. Specific gravity:

0.955 to 0.967 at 15° C. (59° F.). Melting point: 63° to 64° C. (145.4° to 147.2° F.). It is brittle when cold, and when broken presents a dull, granular, not crystalline fracture. By the heat of the hand it becomes plastic. Yellow wax is insoluble in water, sparingly soluble in cold alcohol, but almost completely in boiling alcohol. It is completely soluble in ether, chloroform, and in fixed and volatile oils; partially soluble in cold benzol or carbon disulphide, and completely in these liquids at a temperature of 25° to 30° C. (77° to 86° F.)"—(*U. S. P.*). Wax possesses considerable firmness and tenacity, though somewhat soapy, but not greasy to the touch. At a high temperature it boils, and in close vessels distills over with little alteration; at a red heat its vapor inflames, burning with a dense white brightness. Boiling alcohol dissolves about 20 per cent of it (cerotic acid), but deposits it upon cooling almost completely. Yellow wax is largely a mixture of 3 substances: *Myricin*, or *myricyl palmitate* ($C_{16}H_{31}O_2.C_{30}H_{61}$), which is the principal constituent, not soluble in boiling alcohol, and having its fusing point at 72° C. (161.6° F.); *cerin*, or *cerotic acid*, ($C_{27}H_{54}O_2$) (Brodie), extractible from wax by boiling alcohol, fusing at 78° C. (172.4° F.); and *cerolein*, an acid substance, soluble in alcohol, to which are also due the color and flavor of wax.

Adulterations and Tests.—Both yellow and white wax are liable to adulterations. Resin may be suspected by the fracture being smooth and shining, instead of granular; also by its solubility in cold alcohol. Insoluble mineral and organic substances, like clay, yellow ochre, starch, etc., may be separated by dissolving the wax in chloroform, whereby these substances remain behind. However, this kind of clumsy adulteration is not now liable to occur. Tallow and suet reduce the melting point of wax, and impart an unpleasant odor when melted. Fatty acids, *e. g.*, stearic acid, may also be detected by the formation of a granular precipitate of calcium soap, when the chloroformic solution is shaken with lime water. If the wax contains starch, boil it in water, and add tincture of iodine to it, which will produce a blue color. (For *Myrtle wax* see *Myrica cerifera*). Paraffin is sometimes mixed with wax, which will reduce the specific gravity of the latter. Wax has the specific gravity of 0.955 to 0.967; the specific gravity of paraffin varies from 0.870 to 0.877. Wax, when placed in alcohol (specific gravity, 0.961), will fall to the bottom; should it float, we may suspect it to be mixed with paraffin. The *U. S. P.* directs the following tests for wax: "If 1 Gm. of yellow wax be boiled, for ½ an hour, with 35 Cc. of a 15 per cent aqueous solution of sodium hydrate, the volume being preserved by the occasional addition of water, the wax should separate, on cooling, without rendering the liquid opaque, and no precipitate should be produced in the filtered liquid by hydrochloric acid (absence of fats or fatty acids, Japan wax, resin); nor should the same reagent produce a precipitate in water which has been boiled with a portion of the wax (absence of soap). If 5 Gm. of yellow wax be heated in a flask, for 15 minutes, with 25 Cc. of sulphuric acid, to 160° C. (320° F.), and the mixture then diluted with water, no solid, wax-like body should separate (absence of paraffin). If a portion of yellow wax be ignited on platinum, it should not emit the odor of acrolein (absence of tallow and other fats)"—(*U. S. P.*).

Besides the methods here indicated an extremely useful method of analysis of beeswax has been introduced within the last 15 years, and consists in the determination of the *acid number*, and of the *ether number*, also certain other numbers. The *acid number* denotes the number of milligrams of potassium hydroxide required to saturate the free acids contained in 1 gram of wax. The *ether number* is the number of milligrams of potassium hydroxide necessary to saponify the ethers of 1 gram of wax. As these numbers vary only between narrow limits for pure wax, it is evident that any admixture of an adulterant like rosin, for example, which has a high acid number, may be easily recognized by titration with an alkali. For an interesting and instructive article on the subject of wax analysis, along the lines briefly indicated, see L. F. Kebler, *Amer. Jour. Pharm.*, 1893, p. 585; compare *ib*, p. 380. Also see paper by Prof. Bedford in *Proc. A. P. A.*, 1877, p. 444.

Action and Medical Uses.—Wax exerts little or no influence upon the system, though it has been recommended, combined with olive oil and the yolk of egg, in *diarrhœa*, *dysentery*, and *inflammation of the alimentary mucous membrane*. Its principal employment is in the preparation of ointments, cerates, and plasters, of which it forms an ingredient, imparting to them due consistence and tenacity.

Related Products.—Japan Wax. *Insect white wax of China.*—This wax is said to be obtained in Japan from the *Rhus succedaneum*, and other trees, being produced, as is supposed, by an insect, *Coccus sinensis*, Westwood, which feeds upon the tree. Huber states that the insect has the power of transmuting sugar into wax, which latter is, in fact, a secretion. It is said, however, that the Japanese make candles from the oil of the seeds of the *Rhus succedaneum*; and Nees von Essenbeck states that the wax from this tree greatly resembles the Japanese wax found in commerce. Japanese wax closely resembles white beeswax, but is less white and more yellowish, with a more tender and friable consistence, and a crystalline appearance. It occurs in circular cakes of from 4 to 4½ inches in diameter, nearly an inch thick, flat on one side, and rounded off on the other, as if cast in a small saucer, and is also met with in large square blocks or cases, weighing from 100 to 150 pounds. Its fusing point varies from 45° to 48.8° C. (113° to 120° F.), and, when melted, it will unite with beeswax, lard, etc., and more perfectly incorporates with cacao butter than either spermaceti or wax. It has a rancid-like taste and odor; is far more soluble in alcohol than beeswax, and, unlike this last, it is saponified by caustic alkalies. It is chiefly palmitin, with a small quantity of glycerides of arachidic and stearic acids. It is said to be adulterated sometimes with water, samples containing from 15 to 20, and even 30 per cent of this fluid. When thus adulterated the wax loses its transparent and shining appearance, becomes opaque, white, and very brittle. The water may be separated by simple fusion, or by fusion in water acidulated with sulphuric acid, when the presence of an alkali in the water of falsification is suspected.

Carnauba Wax.—A wax from the north of Brazil, *wax of Carnahuba*, a product of the palm, *Copernicus cerifera*, has been introduced into commerce, which possesses the advantage over beeswax of not melting so readily, as it requires a heat of 84° C. (183.2° F.). It readily saponifies, yielding an acid upon the decomposition of the soap by an acid; treated with alcohol, it gives cerotic acid, which melts at 77° C. (170.6° F.). As it is not affected by finger-marks at the temperature of the hand, it is much used as a furniture polish.

There are other forms of vegetable wax, but they do not enter prominently into our commerce. Among them are Ocotilla Wax (from the bark of *Fouquieria splendens*); Arbol de la Cera (from *Myrica jalapensis*), employed in Mexico in *jaundice* and *diarrhœa*. Ocuba Wax is from the fruit of a Para shrub; while a wax, used by the natives in making candles, is yielded by the *Ceroxylon andicolum*, a palm of the Andes.

CERATA.—CERATES.

Cerates are agents intended for external application, and are composed of wax, or spermaceti, combined with fatty matters, and with which resins, powders, etc., are frequently amalgamated. The articles entering into their composition should always be fresh, especially the fats, as these preparations are very prone to rancidity; the addition of benzoic acid tends to prevent this change, but its presence is not always desirable. Prof. E. S. Wayne found that by substituting paraffin for the wax, in cerates and ointments, the disposition to decompose was considerably retarded. Cerates are firmer in consistence than ointments, and are intended more as a sort of plaster than for inunction. The cerate is intermediate in consistence between the ointment and the plaster, about the consistence of cold butter, and may be spread with a spatula upon cloth or other substance, and be applied to the body, to which it will adhere without melting. In the preparation of cerates the water-bath will be found preferable to a direct exposure to the fire; and to effect the fusion of the materials, a very moderate heat will be sufficient. During the cooling of the compound it should be constantly and thoroughly stirred, not permitting one part to solidify before another. Cerates should be made in small quantity at a time, and should be kept in a cool place, in jars closely covered with tin foil, so as to exclude the air as much as possible. It was at one time thought that the use of wax in these preparations would be entirely superseded by paraffin, which does not become rancid, but experience has shown it to be objectionable on account of the granular character it gives to the cerate. Yellow wax is found to be less liable to become rancid than white wax.

CERATUM (U. S. P.)—CERATE.

Synonyms: *Simple cerate, Lard cerate, Ceratum simplex, Ceratum adipis.*

Preparation.—"White wax, three hundred grammes (300 Gm.) [10 ozs. av., 255 grs.]; lard, seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Melt them together and stir the mixture constantly until it is cool"—(*U. S. P.*).

This preparation should be perfectly bland, and great care should be observed in selecting lard entirely free from rancidity. To prevent any decomposition a low heat should be employed. This is not designed for inunction, though often improperly directed for that purpose. An old formula is as follows: Melt together prepared hog's lard 4 ounces, and white wax 2 ounces, agitating the whole briskly until cool. Put up in small vessels and cover well with tin foil, to protect as much as possible from the action of the atmosphere.

Action and Medical Uses.—Simple cerate forms a mild and cooling application to *irritated surfaces*, *wounds*, *excoriations*, *burns*, *blisters*, etc. Mr. W. J. M. Gordon, pharmacist of this city, formerly prepared a "paraffin cerate," which has been found a very useful article. It is composed of paraffin 2 drachms, oil of almonds ½ ounce, white wax 1 drachm, oil of roses 2 drops. Simple cerate has been advised by G. W. Sloan (*A. P. A. Proceed.*, 1884) as an excipient for certain readily oxidizable pill-masses.

STEATINUM.—A class of substances resembling the cerates in consistence, was proposed by Dr. W. H. Mielcke, in 1881, under the name of *steatina* or *steatins*. Suet or tallow formed the base, which was compounded with other bodies, such as wax, dehydrated lead plaster deprived of its glycerin, nutmeg oil, and various medicaments.

CERATUM CALAMINÆ.—CALAMINE CERATE.

SYNONYMS: *Turner's cerate*, *Cerate of zinc carbonate.*

Preparation.—Take of prepared calamine 1 ounce; simple cerate 5 ounces; mix them well together (*Ed.*).

Or, take prepared carbonate of zinc, wax, of each, ½ pound; olive oil, 16 fluid ounces (Imp.). Melt the wax in the oil, remove them from the fire, and as soon as the mixture begins to concrete, add the carbonate of zinc, and stir briskly until they are cold (*Lond.*).

Action and Medical Uses.—This cerate is an excellent desiccant and astringent application to *burns*, *scalds*, *erysipelatous ulcerations*, *chafings*, etc. (P.).

CERATUM CAMPHORÆ (U. S. P.)—CAMPHOR CERATE.

SYNONYM: *Unguentum camphoratum.*

Preparation.—"Camphor liniment, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; white wax, three hundred grammes (300 Gm.) [10 ozs. av., 255 grs.]; lard, six hundred grammes (600 Gm.) [1 lb. av., 5 ozs., 72 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Melt the white wax and lard with the aid of a gentle heat; then add the camphor liniment, and stir the mixture occasionally until it has become cold"—(*U. S. P.*).

This preparation is somewhat softer than the cerates in general. It contains about 2 per cent of camphor. This preparation, formerly (*U. S. P.*, 1880), contained less than 1 per cent of camphor, and was originally intended and is now used as a basis for the extemporaneous preparation of Goulard's cerate.

Action and Medical Uses.—Antipruritic and slightly anodyne. It possesses no advantages over camphorated oil.

Other Camphor Cerates.—CAMPHOR CERATE, of a former edition of the *French Codex*, is prepared by melting together white wax (1 part), and lard (9 parts), employing moderate heat, and finally stirring into the mixture until dissolved, powdered camphor (3 parts), continuing the stirring until the whole is cold.

CERATUM CAMPHORÆ COMPOSITUM (N. F.), *Compound camphor cerate, Ceratum camphoratum, Camphor ice.—Formulary number*, 19: "Camphor, in coarse powder, one hundred and seven grammes (107 Gm.) [3 ozs. av., 338 grs.]; white wax, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; castor oil, two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.]; spermaceti, four hundred and eighty grammes (480 Gm.) [16 ozs. av., 408 grs.]; carbolic acid, liquefied by warming, two grammes (2 Gm.) [31 grs.]; oil of bitter almond, one gramme (1 Gm.) [15 grs.]; benzoic acid, ten grammes (10 Gm.) [154 grs.]. Melt the white wax and spermaceti on a water-bath, add the castor oil and afterwards the camphor, and continue heating and stirring until the camphor is dissolved. Then withdraw the heat, cover the vessel, and when the mixture has somewhat cooled, add the remaining ingredients, and thoroughly incorporate them by stirring. Lastly, pour the cerate into suitable molds"—(*Nat. Form.*).

For other cerates containing camphor, see *Ceratum Cetacei.*

CERATUM CANTHARIDIS (U. S. P.)—CANTHARIDES CERATE.

Synonyms: *Emplastrum cantharidis, Emplastrum vesicans, Emplastrum epispasticum, Emplastrum vesicatorium, Blistering cerate, Blistering plaster.*

Preparation.—"Cantharides, in No. 60 powder, three hundred and twenty grammes (320 Gm.) [11 ozs. av., 126 grs.]; yellow wax, one hundred and eighty grammes (180 Gm.) [6 ozs. av., 153 grs.]; resin, one hundred and eighty grammes (180 Gm.) [6 ozs. av., 153 grs.]; lard, two hundred and twenty grammes (220 Gm.) [7 ozs. av., 333 grs.]; oil of turpentine, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 36 ♏]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. "Moisten the cantharides with the oil of turpentine, and set the mixture aside, well covered, for 48 hours. Then add it to the yellow wax, resin, and lard, previously melted and strained through muslin, and keep the mixture in a liquid condition, by means of a water-bath, stirring occasionally, until its weight has been reduced to one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Then remove it from the bath, and stir it occasionally until it is cool"—(*U. S. P.*).

This preparation contains 32 per cent of cantharides, and will always vesicate, providing the flies used are of good quality. It should not be heated, in preparation, higher than 100° C. (212° F.), lest the catharidin be lost with the aqueous vapors given off from the powder employed, thus reducing the strength of the cerate. The vapors given off, when heating higher than the above-mentioned point, are liable to produce vesication of the hands and face of the operator. Turpentine, being a solvent of cantharidin, is employed to render that body more readily soluble in the fats employed. In 1860, Wm. R. Warner proposed a formula, which differs principally in embodying an alcoholic extract of cantharides, in place of the powdered drug. This formula was adopted by the *U. S. P.*, of 1880, under the name of Ceratum Extracti Cantharidis, and is by many preferred to the present official cerate. This is practically reproduced in the formula of the *National Formulary* given below.

Action and Medical Uses.—As a blistering agent (see *Cantharis*).

"Ceratum Extracti Cantharidis (N. F.). (*U. S. P.*, 1880). *Cerate of extract of cantharides.*—*Formulary number*, 20: Cantharides, in No. 60 powder, three hundred grammes (300 Gm.) [10 ozs. av., 255 grs.]; resin, one hundred and fifty grammos (150 Gm.) [5 ozs. av., 127 grs.]; yellow wax, three hundred and fifty grammes (350 Gm.) [12 ozs. av., 151 grs.]; lard, three hundred and fifty grammes (350 Gm.) [12 ozs. av., 151 grs.]; alcohol, a sufficient quantity.

"Moisten the cantharides, with one hundred and eighty cubic centimeters (180 Cc.) [6 fl℥, 41 ♏] of alcohol, and pack firmly in a cylindrical percolator; then gradually pour on alcohol, until one thousand eight hundred cubic centimeters (1800 Cc.) [60 fl℥, 415 ♏] of percolate are obtained, or until the cantharides are exhausted. Distill off the alcohol by means of a water-bath, transfer the residue to a tared capsule and evaporate it, on a water-bath, until it weighs one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grains]. Add to this the resin, wax, and lard, previously melted together, and keep the whole at a temperature of 100° C. (212° F.), for 15 minutes. Lastly, strain the mixture through muslin, and stir it constantly until cool" (*Nat. Form.*).

Camphorated Cantharidal Plaster.—A camphorated cantharidal plaster is prepared by spreading a strong ethereal (or chloroformic) solution of camphor on a plaster of cantharides cerate. This, on evaporation, leaves a film of camphor on the surface of the cerate.

Vesicating cloth, or *blistering taffetas*, are occasionally prepared. The *Charta Epispastica* of the *U. S. P.* will probably fulfil all the indications for these various preparations.

CERATUM CETACEI (U. S. P.)—SPERMACETI CERATE.

Synonyms: *Emplastrum spermatis ceti, Ceratum labiale album.*

Preparation.—Spermaceti, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; white wax, three hundred and fifty grammes (350 Gm.) [12 ozs. av., 151 grs.]; olive oil, five hundred and fifty grammes (550 Gm.) [1 lb. av., 3 ozs., 175 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Melt together the spermaceti and white wax; then add the olive oil, previously heated, and stir the mixture constantly until it is cool"—(*U. S. P.*).

This preparation should be perfectly free from lumpiness, should not be rancid, and should have a white color. Should the olive oil be added without previous heating, a lumpy cerate is produced. The following old formula also produces a spermaceti cerate:

"Take of olive oil, 6 parts; white wax, 3 parts; spermaceti, 1 part. Heat the oil gently; add the wax and spermaceti; stir the whole briskly when it is fluid, and continue the agitation until it is cool" (*Ed.*). It is found that this cerate may be preserved a much longer time when made of yellow instead of white wax, and of olive oil not bleached (J. B. Barnes).

Action and Medical Uses.—Spermaceti cerate is used as a mild and unirritating application to *superficial ulcers*, *excoriations*, *blisters*, etc.; more active ingredients are sometimes added to it (P.).

Other Cerates.—Red Lip-salve. Place in a vessel, oil of almonds, 1 pound; spermaceti, white wax, alkanet-root, of each, 2 ounces. Melt over a steam or water-bath, and allow the articles to digest on the alkanet 4 or 5 hours to extract its color; then strain through fine muslin, and add 2 drachms of oil of roses just before the mixture cools. Stir well together.

White Lip-salve.—Melt, as above, oil of almonds, 4 ounces, with white wax and spermaceti, each, 1 ounce. When nearly cool, add oil of bitter almonds, ½ drachm; oil of geranium, 15 minims. Stir thoroughly together. After the lip-salve is poured into pots, and has become cold, a red-hot iron must be held over it temporarily, in order that the heat radiated from the iron may melt the surface of the salve, and make it even and smooth (*Amer. Jour. Pharm.*, Vol. XXVIII, p. 86).

Camphor Cold-cream is made by melting together almond oil, wax, spermaceti, of each, 1 pound; now pass into the mixture, in a very small stream, of rose water, 1 pound, agitating constantly until the whole is introduced and well incorporated. Then add powdered camphor, 2 ounces; oil of rosemary, 1 drachm.

Rose Cold-cream is made similarly of almond oil, rose water, each, 1 pound; white wax, spermaceti, each, 1 ounce; oil of roses, ½ drachm.

Camphor Ball is made by melting together, spermaceti, 3 drachms; white wax, 4 drachms; almond oil, 1 ounce; and then adding powdered camphor, 3 drachms.

Camphor Ice is made by melting spermaceti, 1 drachm, with almond oil, 1 ounce, and adding powdered camphor, 1 drachm (see also *Ceratum Camphoræ Compositum*, N. F.).

Ceratum Rosatum. *Rose cerate, Lip-salve.*—White wax, 50 parts; oil of almonds (expressed), 100 parts; carmine, ½ part; essential oil of rose, ½ part. Rub the carmine with a portion of the oil. Melt the wax and almond oil together with moderate heating; add the carmine (in oil) when the mixture has partially cooled, stirring all intimately together, and lastly, add the oil of rose. This is in accordance with the *French Codex*.

CERATUM CROTONIS.—CROTON-OIL CERATE.

Preparation.—Melt lard, 5 ounces, with white wax, 1 ounce, and, when nearly cool, add croton oil, 2 ounces, and stir until cool.

Action and Medical Uses.—Croton-oil cerate is a rubefacient and vesicant, and may be used in all cases where such actions, or counter-irritation, are demanded.

CERATUM PLUMBI SUBACETATIS (U. S. P.)—CERATE OF LEAD SUBACETATE.

Synonyms: *Unguentum glycerini plumbi subacetatis, Goulard's cerate, Ointment of glycerin of lead subacetate.*

Preparaton.—"Solution of lead subacetate, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; camphor cerate, eight hundred grammes (800 Gm.) [1 lb. av., 12 ozs., 96 grs.]; to make one thousand grammes (1000 Gm.) [2 lb. av., 3 ozs., 120 grs.]. Mix them thoroughly. This cerate should be freshly prepared, when wanted"—(*U. S. P.*).

Care should be taken, in making this cerate, that the camphor cerate be not rancid. Both the *German* and *British Pharmacopœias* employ no fats in the preparation of this cerate, hence their greater stability. Goulard's cerate rapidly assumes a yellow color, and shortly becomes so rancid as to render it unfit for medicinal purposes.

Action and Medical Uses.—Protective and astringent. Should be cautiously used on large raw surfaces, lest lead poisoning ensue from absorption. When rancid this cerate is irritating, and should be discarded, but when freshly prepared, it forms a good dressing for *blisters*, *excoriations*, *ulcers*, and to *suppurative parts*.

CERATUM RESINÆ (U. S. P.)—RESIN CERATE.

SYNONYMS: *Basilicon ointment, Unguentum resinæ, Ointment of resin.*

Preparation.—"Resin, three hundred and fifty grammes (350 Gm.) [12 ozs. av., 151 grs.]; yellow wax, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; lard, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Melt them together at a moderate heat, strain the mixture through muslin, and allow it to cool without stirring. In cold weather use the following proportions; Resin, three hundred and fifty grammes (350 Gm.) [12 ozs. av., 151 grs.]; yellow wax, one hundred and twenty grammes (120 Gm.) [4 ozs. av., 102 grs.]; lard, five hundred and thirty grammes (530 Gm.) [1 lb. av., 1 oz., 304 grs.]"—(*U. S. P.*).

An old formula reads: "Take of resin 5 ounces, axunge (lard) 8 ounces, beeswax 2 ounces. Melt them together with a gentle heat, and then stir the mixture briskly while it cools and concretes" (*Ed.*). Strain it while it is hot.

Action and Medical Uses.—This cerate forms a mildly stimulant, digestive, and detergent application to *ulcers* which follow *burns, scalds*, etc., or which are of a foul or indolent character, and also to *blistered surfaces* to promote a discharge (P.).

CERATUM SABINÆ.—SAVINE CERATE.

SYNONYMS: *Ointment of savin, Unguentum sabinæ.*

Preparation.—Take of lard 7½ ounces, resin 1½ ounces, yellow wax 3 ounces, fluid extract of savin 2 ounces. Melt together the lard, resin, and wax, and when nearly cold, having stirred it constantly, add the fluid extract, and continue the stirring to completion.

Action and Medical Uses.—Savin cerate is applied to *blistered surfaces*, to maintain a constant discharge. It is less irritating than the cerate of cantharides, and has no tendency to excite strangury. When well prepared it has a fine green color, is uniform and transparent, without any tendency to separate, and has a smell like that of the plant.

Related Product.—CERATUM SABINÆ (N. F.) (*U. S. P.*, 1880). *Savine cerate.—Formulary number*, 21: "Fluid extract of savine, twenty-five cubic centimeters (25 Cc.) [325 ♏]; resin cerate, ninety grammes (90 Gm.) [3 ozs. av., 76 grs.]. Melt the resin cerate by means of a water-bath, add the fluid extract of savine, and continue the heat until the alcohol has evaporated; then remove the heat, and stir constantly until cool"—(*Nat. Form.*).

CEREI.—CEREOLI.

SYNONYM: *Bougies.*

Preparation.—Bougies are made by dipping strips of soft linen cloth, bundles of thread, etc., rather wider at one end than at the other, into certain emplastic or elastic compositions, folding them closely, and rolling them firmly on a smooth slab. Ready-made bougies are now a regular article of commerce. The following are some of the compositions held in most repute:

I. BELL'S.—Lead plaster 4 ounces, yellow wax, 1½ ounces, olive oil 3 drachms.

II. HUNTER'S.—Olive oil 3 pounds, yellow wax 1 pound, red lead 1½ pounds; boil together over a slow fire until combined.

III. SWEDIAUR'S WHITE.—White wax 1 pound, spermaceti 3 drachms, acetate of lead from 2 drachms to 1 ounce; boil together slowly.

IV. PIDERIT'S WAX.—Yellow wax 6 parts, olive oil 1 part.

V. GOULARD'S.—Yellow wax 6 ounces, melted and mixed by stirring with Goulard's extract of lead, from 2 drachms to 2 ounces.

VI. ELASTIC.—Boiled linseed oil 12 ounces, amber 4 ounces, oil of turpentine 4 ounces, in which is dissolved caoutchouc 5 drachms. Melt and mix the articles well together, and spread the compound at three successive intervals upon a silk cord or web. Place the pieces so coated, in a stove-oven heated to 65.5° C. (150° F.), and leave them in it for 12 hours, adding 15 or 16 fresh layers in succession, until the instruments have acquired the proper size. Polish first with pumice stone, and finally smooth with tripoli and oil.

Surgical Uses.—Bougies are usually employed for dilating *strictures*, as of the urethra, vagina, neck of the uterus, and rectum. The largest size that can be conveniently introduced is first used, and the size gradually increased as the treatment progresses. The wax bougie is often employed for obtaining the form of a *urethral stricture*, its location and distance from the external orifice.

CEREVISIÆ FERMENTUM.—BEER YEAST.

The ferment obtained in the brewing of beer.

Synonyms: *Brewer's yeast, Barm.*

Preparation.—When an infusion of malt (barley steeped in water, left to incipient fermentation, and dried in a kiln), technically called *Wort*, is subjected to the process of fermentation, a dirty, grayish-brown substance gradually separates, forming in part a frothy scum (*top* or *upper yeast*), and partly a sediment (*bottom* or *lower yeast*); this is *yeast*, or *barm*.

Description and History.—Yeast is a thick, glutinous, foamy-like fluid of a wine-acid odor, and a rather unpleasant taste; it is a very complex mixture, containing water, alcohol, carbonic, acetic, and malic acids, potassium and calcium salts, saccharo-mucilaginous extract, and a cryptogamous growth consisting of nucleated cells, which was formerly named *Torula cerevisiæ*, of Turpin, but now known as *Saccharomyces cerevisiæ*. When exposed to moist air, or to a temperature above 15° C. (59° F.), yeast rapidly decomposes; but when subjected to a gentle heat, so as to dissipate its watery parts, it forms a fragile solid, which may be kept without change for a considerable time, but with a diminution of its fermentative properties.

Neither water nor alcohol dissolve yeast. Its most important property is, that when placed in contact with saccharine solutions at a temperature between 10° and 26.6° C. (50° and 80° F.), it excites vinous fermentation in them, converting their sugar into carbonic acid and alcohol. This was first pointed out by Thénard, in 1803, but the fungi producing this change were observed by Leeuwenhoek as early as 1680. Dr. Christison, by means of yeast, has been able to detect one part of sugar in 1000 parts of urine, of specific gravity 1.030. The cells appear as small, ovoidal, ellipsoidal, or somewhat pyriform, transparent, nucleated bodies, varying in size from $\frac{1}{7500}$ to about $\frac{1}{2500}$ of an inch (P.).

The fermentative power of yeast is much impaired by drying it; a heat of 100° C. (212° F.) destroys yeast when moist, as does the addition of some of the concentrated acids, and of undiluted alcohol. It is also destroyed by boiling water, sulphurous acid, sulphate or acetate of copper, salt, nitrate of silver, black oxide of manganese, carbolic acid, creosote, quinine, strychnine, free alkalies, pyroligneous acid, salts of mercury, essential oils, etc. If, however, fermentation has commenced, the vegetable bases have no specific power of arresting the process. Arsenous acid, acetate of lead, and tartar emetic have no retarding effect upon the progress of fermentation. The keeping qualities and the taste of the products of fermentation depend largely on the nature of the yeast employed. The introduction of pure cultures of these micro-organisms by E. C. Hansen, of Copenhagen, has raised the arts involving fermentation to an almost exact science. For some interesting remarks on fermentation, by M. Pasteur, see *Amer. Jour. Pharm.*, Vol. XXX, p. 328; also see under *Alcohol*.

Yeast may be exposed to a very low temperature (—60° C. [—76° F.]) without losing its vitality, though the plant ceases to form and bud at a temperature of less than 5° C. (41° F.). On the other hand, it may be heated, if no water be present, to 100° C. (212° F.) without destroying its activity, but if water be present, its destruction is accomplished at 75° C. (167° F.). Commercial *dry yeast* is prepared by pressing out most of the water from yeast. *Vienna yeast* is the dried froth from the wort from barley malt, maize, and rye. *Patent yeast* is said to be flour dough mixed with yeast, or hop infusion, with malt added.

Action, Medical Uses, and Dosage.—Stimulant, tonic, nutritious, antiseptic, and laxative. Formerly used in *typhoid fevers* by mouth and injection, and in *tympanitis* by enema. With or without the addition of olive oil, which renders it more laxative, it will be found highly beneficial in all *malignant ulcerations of the throat* and *mouth*, in diseases where there is a disposition to putridity, in *scarlatina*, and *low stages of fever*. Externally, in combination with elm bark and charcoal, it forms an excellent emollient and antiseptic poultice in *sloughing ulcers*, stimulating the vessels, removing the tendency to gangrene, and correcting the fetor. In the *furunculoid epidemic*, which existed in this country and Europe, given internally, in conjunction with quinine, yeast was found effectual in the treatment of *boils, carbuncles*, and *felons*. Yeast in doses of 1 fluid drachm, 3 or 4 times a day, taken immediately before meals, has been advised in *diabetes mellitus*. It has in some instances proved efficient, and is supposed to act by decomposing sugar or preventing its abnormal production in the stomach. The dose of yeast is from ½ to 1 fluid ounce, every 2 or 3 hours.

CERII OXALAS (U. S. P.)—CERIUM OXALATE.

FORMULA: $Ce_2(C_2O_4)_3+9H_2O$. MOLECULAR WEIGHT: 704.78.

SYNONYMS: *Oxalas cericus*, *Cerium oxalicum*, *Oxalate of cerium*, *Cerous oxalate*.

Source and Preparation.—Cerium oxalate is prepared by a tedious method from the Swedish mineral *cerite*, which is composed chiefly of the silicates of cerium, lanthanum, and didymium. "For its production the powdered mineral is digested with hydrochloric acid. The solution is evaporated to a small bulk, treated with sulphide of hydrogen, diluted and filtered. Ammonia water is then added in slight excess, the precipitate collected, washed with water, dissolved by means of diluted hydrochloric acid, and precipitated by solution of oxalic acid. This produces crude oxalate of cerium, from which the impurities (lanthanum and didymium), are separated by calcining it, whereby sesquioxide of cerium is produced with the oxides of other metals. The powder is then digested with solution of sal ammoniac which dissolves all but the cerous oxide. This is then dissolved in diluted hydrochloric acid, and oxalic acid solution added until in slight excess. The precipitate of oxalate of cerium is then dried. It will be observed that the object of the foregoing roundabout process is to obtain *chloride of cerium*, and that from this the oxalate is in reality prepared by decomposition with oxalic acid" (Lloyd's *Chemistry of Medicines*).

Description and Tests.—"A white, granular powder, without odor or taste, and permanent in the air. Insoluble in water, alcohol, ether, or in solutions of potassium or sodium hydrate; soluble in diluted sulphuric or hydrochloric acid"—(*U. S. P.*). When heated in a current of hydrogen it decomposes, leaving the sesquioxide, or so-called *cerous oxide*. Cerium oxalate feels gritty when chewed, and seems to impart a sensation as if the teeth would adhere when moved upon each other.

"When heated to redness, it is decomposed, leaving a residue of reddish-yellow ceric oxide (a brown color would indicate the presence of didymium). On boiling the salt with potassium or sodium hydrate T.S., white cerous hydrate is left as insoluble residue, while in the filtrate, supersaturated with acetic acid, calcium chloride T.S. will produce a white precipitate insoluble in acetic acid, but soluble in hydrochloric acid. If the yellow residue left after heating be dissolved in concentrated sulphuric acid, and a small crystal of strychnine added, a deep-blue color will appear, which will rapidly change to purple and then to red. From the solution in diluted hydrochloric or sulphuric acid, potassium hydrate T.S. precipitates white, cerous hydrate, which does not redissolve in an excess of the reagent, and gradually turns yellow in contact with air. Ammonium carbonate T.S. precipitates white, cerous carbonate, which is somewhat soluble in an excess of the reagent. If 0.1 Gm. of cerium oxalate be dissolved in 1 Cc. of sulphuric acid, and 2 Cc. of potassium sulphate T.S. be added, small, colorless crystals of cerium potassium sulphate will be deposited after some time. No effervescence should occur when the salt is dissolved in diluted hydrochloric acid (absence of carbonate); nor should the solution be colored or rendered turbid on the addition of an equal volume of hydrogen sulphide T.S. (absence of arsenic, etc.). On boiling the salt with potassium or sodium hydrate T.S. and filtering, no precipitate should be produced in the filtrate either by ammonium chloride T.S. (absence of aluminum), or by ammonium sulphide T.S. (absence of zinc)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Cerium oxalate allays certain forms of *vomiting*, being best adapted to that reflex disturbance of uterine origin, and less valuable where the vomiting depends upon simple gastric irritation or destructive processes going on within the stomach. To a certain extent it will sometimes relieve the vomiting due to gastric irritability in *dyspepsia*, *phthisis*, and other *chronic wasting diseases*. Its reputation as a remedy for *cough* and *chorea* has not been well sustained. Its most decided effects are in the *vomiting of pregnancy*, and even here it often fails. Prof. Scudder alludes to its probable special influence upon the female reproductive apparatus, and states that he has given the remedy (2 x trit.) in *ulcerated cervix uteri* and *uterine irritation* with leuchorrhœal discharges, with apparent success. It has been asserted a useful remedy for *dysmenorrhœa* in robust, fleshy women, with scanty menses, and spasmodic, colicky, or tenesmic pain before or at the beginning of the flow, relief following the free establishment of the discharge. Six grains are given every hour until relieved (Webster, *Dynam. Therap.*, from *Med. Record*).

The dose of cerium oxalate ranges from 1 to 10 grains (preferably in powder), from 1 to 3 grains being the ordinary dose—every 4 hours. The valerianate of cerium is also used in the same doses for *vomiting of pregnancy*.

Specific Indications and Uses.—Nausea and vomiting of pregnancy with nervousness; dysmenorrhœa of plethora, with colicky, tenesmic pain at the outset.

Cerium and Its Salts.—Cerium (Ce). Atomic weight, 141.2. Klaproth discovered this metal in 1803, though he believed it to be an earth. Simultaneously Berzelius and Hisinger obtained the metal, all three extracting it from the Swedish mineral *cerite* above noticed. Later it was obtained by Mosander by heating cerium chloride and sodium together, and Hillebrand and Norton obtained it from the chloride by electrolysis. The mineral *allanite*, found in New York and Pennsylvania, as well as in Scandinavia, contains the same silicates that cerite holds. Among other minerals *orthite*, *gadolinite*, etc., of northern Europe contain it. Cerium resembles in color iron, and like it tarnishes in the presence of a moist atmosphere, yellow, blue, and green shades being produced. Though hard, when warm it is malleable, and may be drawn into wire. Beautiful scintillations are produced when the metal is struck with flint, and it burns even more brilliantly in the air than magnesium. Two oxides are known, the blue-green powder, cerium sesquioxide (*cerous oxide*) (Ce_2O_3), and the white or pale-yellow cerium dioxide (*ceric oxide*) (CeO_2). Corresponding to these oxides are the two lines of *cerous* and *ceric* compounds.

Cerii Nitras ($Ce[NO_3]_3.6H_2O$). Cerium nitrate forms very deliquescent prisms or scales, colorless, and readily soluble in water or alcohol. It is prepared by double decomposition of barium nitrate and cerous sulphate. Simpson, the discoverer of the medicinal properties of the cerium compounds, employed it as a nerve tonic. Probably of little value.

Cerii Bromidum.—A sweet, chocolate-colored mass, having a styptic action, readily soluble in alcohol, but when added to water leaving an insoluble cerous salt. It is prepared by dissolving cerous carbonate in hydrobromic acid, and evaporating (Bullock, *Amer. Jour. Pharm.*, 1871).

Cerii Carbonas ($Ce_2[CO_3]_3.9H_2O$). Scales of a silver-like brilliancy, produced by the changing of the flocculent white precipitate thrown down when cerous sulphate is decomposed by ammonium carbonate. Not soluble in water.

CETACEUM (U. S. P.)—SPERMACETI.

"A peculiar, concrete, fatty substance, obtained from *Physeter macrocephalus*, Linné.

Class: Mammalia. *Order:* Cetacea.

Source and Preparation.—Spermaceti is obtained from the cachalot, or sperm whale, the *Physeter macrocephalus* of naturalists, a species of the order *Cetacea*, and family *Physeteridæ*. It is a gregarious animal, inhabiting the Pacific ocean, the Indian Archipelago, and the Chinese and Australian seas. It varies in size, being from 50 to 80 feet in length, with a huge, quadrangular head, from 20 to 30 feet or more in circumference, and which constitutes about a third of its whole length. Spermaceti is found in various parts of its body, in small proportions, dissolved in its blubber, but that which is met with in commerce is obtained from large cavities in the upper part of the head; these are divided into numerous cells, which are filled with a milky, oleaginous solution of spermaceti. From a large whale 40 to 60 hundred weight, of this fluid may be collected. It is removed from the cavities and boiled to separate the oleaginous matter from the solid substance, and as it cools, the spermaceti crystallizes. The oil is then drained off as much as possible, and the remainder is removed from the spermaceti by powerful pressure. The crude spermaceti is subsequently purified by fusing and skimming it, then fusing it in weak lye of potassa, and finally by a third fusion at a gentle heat; after which it is solidified in tin molds.

Description, Chemical Composition, and Tests.—Spermaceti is a concrete, crystalline, foliaceous, pearly-white substance, without much taste or odor, easily indented or scraped by the nail, slightly greasy, pulverizable on the addition of a little alcohol, or almond oil, fusible and combustible. It is freely soluble in boiling alcohol, which deposits it on cooling; also in fused fats or resins. It is soluble in sulphuric acid, which decomposes it, but the other mineral acids do not influence it. It differs from ordinary fats in not yielding glycerin when saponified, but in furnishing in its stead a monobasic alcohol termed *ethal*, or *cetyl alcohol* ($C_{16}H_{33}.OH$). The *U. S. P.* describes spermaceti as in "white, somewhat translucent, slightly unctuous masses of a scaly-crystalline fracture and a pearly lustre; odorless, and having a bland, mild taste. It becomes yellowish and rancid by exposure to the air. Specific gravity, about 0.945 at 15° C. (59° F.). It melts near 50° C. (122° F.), and congeals near 45° C. (113° F.). Insoluble in water, and nearly so in cold alcohol; soluble in boiling alcohol; also in ether, chloroform, carbon disulphide, fixed and volatile oils; only slightly soluble in cold benzin. An alcoholic solution of spermaceti is neutral to litmus paper. If 1 Gm. of spermaceti be boiled with 1 Gm. of anhydrous sodium carbonate, and 50 Cc. of alcohol, and the mixture cooled and filtered, the filtrate, upon being supersaturated with acetic acid, may become turbid, but should not afford a precipitate (absence of stearic acid)"—(*U. S. P.*). Exposed for a length of time to atmospheric influence, spermaceti becomes yellow and rancid, owing to a small portion of oil (*oil of spermaceti*) contained in it, but may be purified by boiling in alcohol, which deposits the pure spermaceti as it cools. By this method, or when it is deprived of oil by means of an alkali, it becomes a nearly pure proximate principle, intermediate between wax and the concrete oils, and presenting all the leading properties of the ordinary article, but less unctuous, rather harder, and fusible only at 49° C. (120.2° F.). It is then termed *cetin* (*cetyl palmitate*) ($C_{16}H_{33}.C_{16}H_{31}O_2$), and is soluble in 40 parts of boiling alcohol of specific gravity 0.821. When boiled in a solution of caustic potash, cetin is partially saponified, forming a brittle soap composed chiefly of palmitate of potassium, oleate of potassium, and a crystalline principle called *ethal* ($C_{16}H_{34}O$) (*cetyl alcohol*, or *cetyl hydrate*), and which soap is not wholly soluble in water. When melted or dissolved in hot alcohol it crystallizes beautifully; when acted on by nitric acid, it yields first, pimelic acid, which is then oxidized into adipic acid, which is finally converted into succinic acid. Besides cetin, *stearic*, *lauro-stearic*, and *myristic acids*, as well as other and higher alcohols, besides *ethal*, are present in spermaceti.

Action, Medical Uses, and Dosage.—Demulcent and protective, combined with equal parts of loaf-sugar, once used among children in domestic practice in *coughs*, *colds*, and *catarrhal affections*, and in *irritation of the intestinal mucous membranes*. If to spermaceti be added half its weight of olive oil, and after mixing this, powdered gum Arabic be added, and, finally, some water be added by degrees, an emulsion may be formed, useful for children and infants. Hollandt states that spermaceti may be reduced to the most impalpable powder, by melting it over a gentle fire, and then stirring it in a previously-warmed mortar until cold.

Spermaceti forms a useful ingredient of several cerates and ointments. It enters into the formation of a crayon which is of much value to chemists, druggists, and others, inasmuch as it enables them to write upon clean glass. It is made by fusing in a cup 4 drachms of spermaceti (or stearin), 3 drachms of tallow, and 2 drachms of wax; after which 6 drachms of red lead, and 1 drachm of potassa are to be stirred into it, keeping the whole mass warm for ½ hour, when it is poured into glass tubes the thickness of a lead-pencil.

Related Wax.—Black Wax. An animal product introduced into England from the Pacific Islands and India.

CETRARIA (U. S. P.)—CETRARIA.

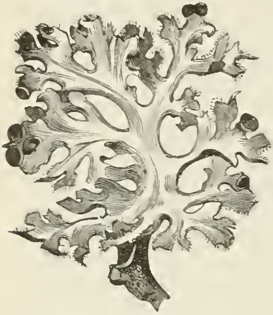
The lichen, "*Cetraria islandica* (Linné) Acharius"—(*U. S. P.*). (*Lichen islandicus*, Linné).

Class: Lichenes.

Common Names: *Iceland moss*, *Iceland lichen*.

Botanical Source.—Iceland moss is a perennial, foliaceous plant, from 2 to 4 inches high; the thallus is erect, tufted, olive-brown, paler on one side, laciniated, channeled, and dentato-ciliate, the fertile lacinæ being very broad. The shields are brown, oppressed, and flat, with an elevated border (L).

Fig. 65.



Cetraria islandica

History.—This lichen is a native of the mountainous section of Britain and the northern countries of Europe, particularly Iceland. It is found as far south as France, Italy, Switzerland, and Spain, growing in mountainous elevations. It is likewise found in the antarctic countries, British America, and in the United States from the eastern states to the mountains of Carolina and westward to the Rocky Mountains, from Colorado northward. In northern Europe it has long been used for food under the name *mosi*, *mus*, or *mossa* (*Pharmacographia*). Though called Iceland moss, none is exported from that island. It is diversified in color, being brownish or grayish-white on some parts, and of a reddish hue in others; it is without odor, with a mucilaginous, bitter, somewhat astringent taste, and when dry the lichen is crisp, cartilaginous, and coriaceous, and is convertible into grayish-white powder. It swells up in water, absorbing more than its own weight of that fluid, communicating a portion of its bitterness to it, as well as a little mucilage. When long chewed it is converted into a mucilaginous pulp, and when boiled in water the decoction becomes a firm jelly on cooling.

Description.—The following article is required by the Pharmacopœia: "From 5 to 10 Cm. (2 to 4 inches) long, foliaceous, irregularly branched into fringed and channelled lobes, brownish above, whitish beneath, and marked with small, depressed spots; brittle and inodorous; when softened in water, cartilaginous, and having a slight odor; its taste is mucilaginous and bitter. It should be freed from pine leaves, mosses, and other lichens, which are frequently found mixed with it"—(*U. S. P.*).

Chemical Composition.—Iceland moss consists of starchy lignin, a peculiar starch, gum, uncrystallizable sugar, a substance closely related to chlorophyll, wax, various salts, and a bitter principle called *cetrarin* or *cetraric acid* ($C_{18}H_{16}O_8$), which it is said, has been used in Italy for cinchona. Christison states that it may be obtained pure "by boiling the coarsely-powdered lichen in 4 times its weight of rectified alcohol, filtering the solution when tepid, acidulating it with diluted hydrochloric acid, diluting it with 3 times its volume of water, and purifying the crystals which slowly form, by squeezing them and washing them with a little ether." As thus obtained, *cetrarin* is in white, microscopic, acicular crystals, permanent, odorless, intensely bitter, insoluble in water, sparingly so in cold alcohol, more so in boiling alcohol, or ether, and readily soluble in alkaline solutions. When its alkaline solutions are treated with acids, the *cetrarin* is procured without being changed in its properties; concentrated hydrochloric acid converts it into a blue coloring matter. It is said to prove an efficient febrifuge in 2 or 3 grain doses, administered every 2 or 3 hours. Iceland moss also contains *lichenostearic acid* ($C_{14}H_{34}O_3$), *fumaric acid* (*lichenic acid* of Pfaff [1826]), oxalic and tartaric acids, and *thallochlor* (of Knop and Schnedermann), a chlorophyll unaffected by chlorhydric acid. The most important part of Iceland moss is its nutritive principle, to which the name of *lichenin* or *lichen-starch* has been given, and which exists to the extent of 70 per cent. It may be obtained by macerating the chopped lichen for 24 hours in 18 parts of water, containing $\frac{1}{250}$ of its weight of carbonate of potassium—strain off the bitter solution without pressure, and remove the rest of it from the residuum by maceration with cold water and simple straining. Boil the residuum in 9 parts of water down to 6, strain the decoction, and squeeze what is left in the cloth, and then allow the strained liquor to cool. A firm jelly is formed, which cracks and throws out much of the water, and then dries into a hard, black, glassy-like substance. The black coloring matter may be removed by boiling again, straining, cooling, and drying; upon which the *lichenin* is obtained in thin, transparent, and tough plates of a yellowish color. Cold water renders it gelatinous, boiling water dissolves it, forming a jelly on cooling; alcohol and ether do not affect it. Iodine renders its watery solution blue, and it is converted into sugar by sulphuric acid, and into oxalic acid by nitric acid. According to Berg this body is made up of a substance for which he retains the name *lichenin*, and another constituent, which alone imparts the blue color to iodine. Out of 30 per cent obtained from the drug, 10 per cent was of this latter body, unnamed by him, but for which others have proposed the name *lichenoid* (*isolichenin*). This latter principle is freely soluble in cold water, but very sparingly soluble in boiling water. Lichenin has the same composition as that of starch and cellulose ($C_{12}H_{20}O_{10}$), and is believed to be a modification of the latter, and in some respects resembles amidin.

Preparations.—ICELAND MOSS JELLY (*Gelatina lichenis islandici*). Washed Iceland moss 3 parts, water 100 parts. Make a decoction, strain, add white sugar 3 parts, and evaporate the whole to 10 parts. Official in *Pharmacopœia Germanica.*

DRIED SACCHARATED ICELAND MOSS (*Gelatina lichenis islandici saccharata sicca*).—Iceland moss 10 parts. Deprive the lichen of its bitterness by heating to 100° C. (212° F.), in a small amount of water, express, and wash with cold water. Boil the residue in water an hour, strain and decant the decoction, mix with sugar 10 parts, evaporate, dry and pulverize. This gives a grayish-brown product. This is official in the *French Codex.*

To deprive Iceland moss of its bitterness, the *Pharmacopœia Germanica* directs, Iceland moss 15 parts, to be macerated in tepid water 90 parts, containing carbonate of potassium 1 part, for 3 hours. The product is subsequently thoroughly washed with cold water.

Action, Medical Uses, and Dosage.—Demulcent, tonic, and nutritious. Excessive doses may induce nausea and looseness of the bowels, while ordinary doses improve the appetite, digestion, and general nutrition. Constipation is not produced by it, and the circulation is unaffected. Its nutritive qualities are undoubtedly due to its starch. The bitterness of cetrarin may be detected in the nursing mother's milk. Used as a demulcent in *chronic catarrhs, chronic dysentery* and *diarrhœa*, and as a tonic in *dyspepsia, convalescence*, and *exhausting diseases.* Boiled with milk it forms an excellent nutritive and tonic in *phthisis* and *general debility.* It relieves the cough of *chronic bronchitis.* Its tonic virtues depend on its cetrarin, the bitter principle which, if removed, renders the lichen merely nutritious. Dose in powder, 30 to 60 grains; of cetrarin, 1½ to 3 grains. The jelly and decoction are most generally employed.

CHAMÆLIRIUM (HELONIAS.)—BLAZING STAR.

The rhizome of *Chamælirium luteum*, Gray (*Helonias dioica*, Pursh; *Helonias lutea*, Aiton).

Nat. Ord.—Liliaceæ (Melanthaceæ, Br.).

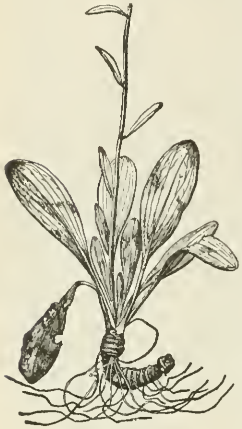
COMMON NAMES: *Unicorn root, False unicorn root, Blazing star, Starwort.*

ILLUSTRATION: (See *American Dispensatory*, eighth and succeeding editions).

We have adopted *Gray* as authority in the name of this plant, therefore the term *Helonias dioica* of former editions will be replaced to conform with the generally accepted classification. The common name is *Unicorn root*, derived from the fact that the rhizome resembles a horn. Afterward this term was applied to *Aletris farinosa*, which is thus the *False unicorn.* Chamælirium is also known under the names *Drooping starwort, Devil's bit*, and in former editions of this work, and in other books, as *False unicorn.*

Botanical Source.—The Chamælirium is an erect, slender herb, about 2 feet high, and without branches. The stem is smooth, round, striate, and terminates in a long, slender spike of small white flowers. The lower leaves are obovate-spatulate, smooth, entire, alternate, and exstipulate. They are clustered in at the base of the stem, gradually becoming smaller until the upper are reduced to scales. They are attached at an acute angle to the stem. The radical leaves are obtuse, but those on the upper part of the stem are acute; the veins are parallel, and run lengthwise along the leaf, but are not prominent. The flowers are very small, and the fertile and sterile are on different stems; the fertile stems being much more leafy than the sterile. The female flowers consist, each, of 6 small, linear, white petals, a small, globular ovary, about the size of a grain of hemp seed, with 3 linear stigmas about the length of the ovary; each one is succeeded by a dry, oblong capsule, opening by 3 valves at the apex, and containing numerous minute seeds. The sterile flowers are in spikes much longer than those of the fertile, and are from 4 to 6 inches in length. They have 6 linear petals, and the same number of stamens, which have unequal filaments about twice the length of the petals; the anthers are small and globular. The aspect of the flowering stems of male and female plants is very different, and they would hardly be attributed to the same species by one who has not closely examined them.

Fig. 66.



Chamælirium luteum.

History.—This plant is indigenous to the United States, and is abundant in some of the western states, growing in woodlands, meadows, and moist situations, and flowering in June and July. It is also found in low grounds from Canada to Georgia and Louisiana.

The rhizome of this plant has long been confounded with, and sold for, that of *Aletris farinosa*, and to such an extent that druggists generally have concluded the two must bear a very close resemblance. This is a mistake, as there is scarcely any likeness between them. The impression as to their similarity of appearance was strengthened by the *American Dispensatory*, p. 419, eighth and succeeding editions, viz.: "There has been, and still exists, much difficulty among druggists and herb-gatherers, in determining the difference between the roots of *Aletris farinosa* and *Helonias dioica*, as they greatly resemble each other," etc. With the view of correcting previous mistakes, and setting right the history of the two plants, we have produced fac-simile drawings of both plants (Figs. 14 and 66), and by a simple reference to our engravings of Aletris farinosa and a comparison with that of Chamælirium, it will be obvious: (1) "That the shape of the leaves and general appearance of the plant are entirely different. (2) The rhizomæ are utterly unlike, and do not in the least resemble each other."

It is to be regretted that so much confusion has existed with regard to these rhizomæ, and the difficulty must be ascribed to the *common names* given them, and not to a resemblance. We have upon the market, the rhizomæ of *Unicorn* and *False unicorn*, of *Stargrass* and *Starwort*, *Helonias dioica*, and *Aletris farinosa* and the majority of dealers and therapeutists are by no means decided as to the identity of either of them. When ordered by their common names, the roots from one section of country will be the reverse of those from other sections; and when stargrass or unicorn root is sold to a druggist the dealer is uncertain as to whether it will not be returned as "different from that previously purchased." Strict conformity to botanical names will assist in overcoming this extended and serious evil.

Description.—The rhizomæ of chamælirium are from ½ an inch to 2 inches in length, and, when dry, average from ¼ of an inch to ½ an inch in diameter. They are mostly curved (horn shape), but some are nearly straight; usually premorse (as though bitten off), but sometimes they are pointed. Externally, they are dark-brown, transversely wrinkled, rough and uneven, showing the stem-scars upon the upper side. Around the entire rhizome are fibrous rootlets, scattered above and thicker below. The fresh fibers are succulent, with the exception, however, of a hard, ligneous, thread-like center, which remains from one season to another long after the soft external portion has decayed. This gives rise to the appearance of pores or pin-holes upon the surface of the root, through many of which the woody fibers still pass, and extend, as fragments, from ½ an inch to 2 inches beyond the surface, and internally, to the central part of the rhizome. When the fibers are entirely decayed, the small, pin-like holes remain and are often mistaken for worm-holes. Remains of radical leaves are occasionally found attached to the upper end of the rhizome, below which will often be observed a bunch of dried fibers, and along the upper side of the rhizome may be seen the bases of several annual stems or stem-scars. Internally, the rhizome is very hard, of a horn-like color and texture, about ⅓ of the central portion being a little lighter, and partly composed of fibrous matter, from the surface of which the rootlets rise. The dried rhizomæ exhale a peculiar, characteristic, not unpleasant odor, more strongly developed when bruised, or rubbed between the fingers. The taste is very bitter, disagreeable and acrid. The virtues are extracted by alcohol, and, when fresh, by alcohol or boiling water.

Chemical Composition.—The rhizome contains a yellowish bitter principle, for which the name *chamælirin* has been proposed by Dr. F. V. Greene. It is a neutral body in the form of a powder, insoluble in the ordinary solvents, except alcohol and water, with both of which it gives frothy solutions after the manner of saponin. By treatment with diluted acids it is resolved into grape sugar and *chamæliretin*, a resinous body dissolving in ether and alcohol. Chamælirin is said to act as a heart poison.

Action, Medical Uses, and Dosage.—Helonias is tonic, diuretic, and vermifuge; in large doses, emetic, and, when fresh, sialagogue. In doses of 10 or 15 grains of the powdered root, repeated 3 or 4 times a day, it has been found very beneficial in *dyspepsia*, *loss of appetite*, and for the removal of *worms*. It is more especially applicable in *indigestion*, *dyspepsia*, and *mal-assimilation*, where the trouble is reflex from, or associated with wrongs of the female reproductive apparatus. Such digestive disturbances as depend upon uterine and ovarian irritation, or upon lack of uterine activity, in *chlorotic anemia*, are benefited by it, as well as the gastric complications of *albuminuria*. It is not, however, of much value in albuminuria itself. It is said to render the urine alkaline. It is reputed beneficial in *colic*, and is valuable in *atony of the generative organs*. I have found this plant to possess a decidedly beneficial influence in cases of sexual lassitude in both sexes, and of *nocturnal emissions*, the result of excesses, especially in those instances where there are symptoms of gastric derangement with impaired memory, mental apathy, or indifference, and an enfeebled condition of the general system, with weakness or dull pain in the renal, or lumbo-sacral region (King). In diseases of the reproductive organs of females, and especially of the uterus, it is one of our most valuable agents, acting as a uterine tonic, and gradually removing abnormal conditions, while at the same time it imparts tone and vigor to the reproductive organs. Hence, it is much used in *leucorrhœa*, *amenorrhœa*, *dysmenorrhœa*, and to remove the tendency to repeated and successive *miscarriages*. A particular phase removed by it is the irritability and despondency that often attends uterine troubles. In *painful menstruation* it has been found especially adapted to those cases in which there is pelvic fullness, a sensation as if the womb and rectum were distended with blood, and the aching, bearing-down organs feel as if they would fall out of the body. Its action here is very decided when the smaller doses are employed. It is considered useful by some for the relief of the *vomiting of pregnancy*. Helonias is a decided tonic to the urinary tract, and has exerted some benefit in *diabetes insipidus*. The plant is said to kill cattle feeding on it; and the decoction to kill insects, bugs, and lice. Dose of the powder, from 20 to 40 grains; of the decoction, from 2 to 4 fluid ounces; of a saturated tincture, from 10 to 30 minims; of the hydro-alcoholic extract, from 2 to 4 or 5 grains; specific helonias, 1 to 20 drops. The *Helonias bullata*, with purple flowers, and probably some of the other species, possess similar medicinal virtues.

Owing to the confusion that once existed (compare *Aletris* and *Chamælirium*) concerning the rhizomes furnishing helonias and aletris, the therapy of these drugs have been heretofore similarly given. Aletris, however, is more adapted to digestive disorders, while helonias is chiefly a uterine tonic.

Specific Indications and Uses.—Mental irritability and despondency; sexual lassitude; atony of the female reproductive organs; gastric debility, with anorexia, nausea, indigestion, and mal-assimilation, particularly when due to reflexes of uterine origin; sticky, slimy leucorrhœa; atonic urinary tract; dysmenorrhœa, with pelvic fullness and heaviness, as if congested, with a bearing-down sensation, as if the parts were about to fall out.

CHARTÆ.—MEDICATED PAPERS.

This class is known as medicated papers, and was introduced into the *U. S. P.* in 1870, having previously been official in the *French Codex* and *British Pharmacopœia.* The processes of preparation are given under each particular paper, the modes of coating, etc., necessarily varying according to the material employed. They (excepting potassium nitrate paper) are like plasters, differing, however, in being spread upon non-absorbent, or sized paper.

CHARTA CANTHARIDIS (N. F.)—CANTHARIDES PAPER.

SYNONYMS: *Charta epispastica, Charta vesicatoria, Blistering paper, Cantharides paper* (*U. S. P.*, 1880.) *Formulary number*, 22.

Preparation.—The *Nat. Form.* directs: "White wax, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; spermaceti, thirty grammes (30 Gm.) 1 oz. av., 25 grs.]; olive oil, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; Canada turpentine, ten grammes (10 Gm.) [154 grs.]; cantharides, in No. 40 powder, ten grammes (10 Gm.) [154 grs.]; water, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Mix all the substances in a tinned vessel, and boil gently for 2 hours, constantly stirring. Strain through a woolen strainer without expressing, and by means of a water-bath, keep the mixture in a shallow, flat-bottomed vessel with an extended surface. Coat strips of sized paper with the melted plaster, on one side only, by passing them successively over the surface of the liquid; when dry, cut the strips into rectangular pieces"—(*Nat. Form.*).

Action and Medical Uses.—Applicable as a blistering agent when vesication is to be accurately limited, but less efficient than cantharides cerate when full and pronounced vesication is required. The parts must be well washed with soap and water before applying the paper.

CHARTA POTASSII NITRATIS (U. S. P.)—POTASSIUM NITRATE PAPER.

SYNONYMS: *Saltpetre paper.*

Preparation.—"Potassium nitrate, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; distilled water, eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏]. Dissolve the potassium nitrate in the distilled water. Immerse strips of white, unsized paper in the solution, and dry them. Keep the paper in well-closed vessels"—(*U. S. P.*).

In making this preparation, which is sometimes known as *asthma paper*, it is essential that a paper free from chlorine and its compounds, and a potassium nitrate uncontaminated with chlorides be employed. If the medicated paper is to be used in making moxas, these precautions are not so necessary. The potassium salt should be completely dissolved, so that aggregations of the salt may not form upon the paper, thus causing the paper to burn unevenly. *Medicated cigarettes* may be prepared from this paper by rolling it with such leaves as those of belladonna, stramonium, digitalis, hyoscyamus, sage, etc., or the paper may be formed into a quill, whose edges are held in contact with each other by means of a little gelatin, and the medicated substance to be inhaled introduced into the hollow tube. *Moxas* may be prepared by rolling the nitrated paper into firm, cylindrical sticks about ¼ inch in thickness and cutting them into sections of the desired length.

Action and Medical Uses.—This paper is to be burned and the fumes inhaled for the relief of *nervous asthma*. It is thought by some that the heating converts the potassium nitrate into potassium nitrite.

CHARTA SINAPIS (U. S. P.)—MUSTARD PAPER.

Preparation.—"Black mustard, in No. 60 powder, one hundred grammes (100 Gm.) [3 ozs. av., 213 grs.]; India rubber, ten grammes (10 Gm.) [154 grs.]; benzin, carbon disulphide, each a sufficient quantity. Pack the black mustard in a conical percolator, and gradually pour benzin upon it until the percolate ceases to produce a permanent, greasy stain upon blotting paper. Remove the powder from the percolator, and dry it by exposure to the air. Having meanwhile dissolved the India rubber in a mixture of one hundred cubic centimeters (100 Cc.) each, of benzin and carbon disulphide, mix the purified mustard with a sufficient quantity of the solution to produce a semi-liquid magma, and apply this, by means of a suitable brush, to one side of a piece of rather stiff, well-sized paper, so as to cover it completely, and then allow the surface to dry. A surface of sixty square centimeters should contain about 4 Gm. of black mustard deprived of oil. Before it is applied to the skin, mustard paper should be dipped in warm water for about 15 seconds"—(*U. S. P.*).

That of the *British Pharmacopœia* is inferior to this paper, inasmuch as the oil is not extracted from the mustard, nor has the paper prepared with gutta-percha solution the flexibility of that made as above directed. While not as useful as mustard cataplasm, mustard paper is more convenient for travellers, and has the advantage of being always ready for use.

Action and Medical Uses.—In this paper the adhesion is perfect, and the preparation remains unalterable by time or atmospheric action. To use it requires only to wet it with water for 12 or 15 seconds, and then apply upon the skin, when it becomes a most active sinapism. M. Paul Rigollot is the inventor. This sinapism has been found more efficient than ammonia in the *bites* or *stings* of horse-flies, gnats, mosquitoes, bees, wasps, etc. As soon as the first sensation of the sinapism is felt, the pain and swelling rapidly disappears, and in from 1 to 24 hours the cure is complete. It may be used in all cases where a sinapism is indicated, except, perhaps, in a mustard foot-bath; it requires no loss of time in preparation, no water, no fire, no flour, no linen, is easily conveyed about, and acts promptly.

CHELIDONIUM (U. S. P.)—CHELIDONIUM.

"The entire plant, *Chelidonium majus*, Linné"—(*U. S. P.*).

Nat. Ord.—Papaveraceæ.

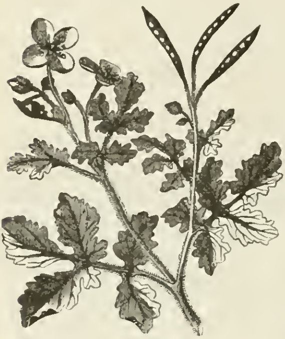
COMMON NAMES: *Celandine, Chelandine, Tetterwort, Great celandine.*

ILLUSTRATION: Köhler's *Medicinal Pflanzen*, Vol. I, Plate 21.

Botanical Source.—This plant is an evergreen perennial, with a stem from 1 to 2 feet in height, branched, swelled at the joints, leafy, round, and smooth. The leaves are smooth, spreading, and very deeply pinnatifid. The leaflets, in from 2 to 4 pairs, from 1½ to 2½ inches long, about ⅔ as broad, terminal one largest, all ovate, and cuneately incised or lobed; the lateral ones sometimes dilated at their lower margin, near the base, almost as if auricled; color of all a deep, shining green. The flowers are bright yellow, umbellate, and are borne on long, often hairy stalks; umbels thin, axillary, and pedunculate; calyx tawny, often hairy; petals 4, entire, yellow, and very fugacious; stamens numerous; capsules long, torulose, 2-valved, and 1-celled; seeds black and shining, each with a whitish, deciduous crest (L.).

History.—Celandine is a pale-green, fleshy herb, indigenous to Europe, and naturalized in this country; it grows along fences, by roadsides, in waste places, etc., and flowers from May to October. When the plant is wounded, a bright-yellow, offensive juice exudes, which has a persistent, nauseous, bitter taste, with a biting sensation in the mouth and fauces. The root is the most intensely bitter part of the plant, and is more commonly preferred. Drying diminishes its activity. It yields its virtues to alcohol or water. The plant should be collected while in bloom.

Fig. 67.



Chelidonium majus.

Description.—"Root several headed, branching, reddish-brown; stem about 50 Cm. (20 inches long), light-green, hairy; leaves about 15 Cm. (6 inches) long, thin, petiolate, the upper ones smaller and sessile, light-green, on the lower side glaucous, lyrate-pinnatifid; the pinnæ ovate-oblong, obtuse, coarsely crenate or incised, and the terminal one often 3-lobed; flowers in small, long-peduncled umbels, with 2 sepals and 4 yellow petals; capsule linear, 2-valved, and many-seeded. The fresh plant contains a saffron-colored milk-juice, and has an unpleasant odor and acrid taste"—(*U. S. P.*).

Chemical Composition.—Analysis has detected in this plant a deep-yellow bitter, resinous substance, an orange-colored, nauseous, and bitter gum-resin, mucilage, albumen, free malic acid, silica, and various salts (Chevallier and Lassaigne). Probst (1838) obtained a peculiar acid termed *chelidonic acid*; and an alkaloidal principle, forming neutral red salts with acids, which are narcotic and poisonous, denominated *chelerythrine* (*pyrrhopine*) ($C_{19}H_{17}NO_4$), predicted by Probst (1840) to be identical with *sanguinarine*, which Schiel, of St. Louis (1855), proved to be the case. More recently, however, G. König (1891) assigns to sanguinarine the formula $C_{20}H_{15}NO_4$, and pronounces chelerythrine to be *methyl sanguinarine* ($C_{21}H_{17}NO_4$) (see *Amer. Jour. Pharm.*). It is a gray powder, and excites violent sneezing when snuffed into the nostrils. Another alkaloidal principle, bitter, insoluble in water, and forming crystallizable salts, is called *chelidonine* ($C_{19}H_{17}N_3O_3$); also a neutral, yellow, crystallizable bitter principle, is termed *chelidoxanthin.*

The alkaloids are held in combination with malic acid and *chelidonic acid* ($C_7H_4O_6$), a bibasic acid capable of dissolving iron and zinc. It occurs in silky, acicular crystals, has a very sour taste, decomposes the alkaline carbonates, dissolves in hot water, slightly in alcohol and cold water, and when boiled with an alkali, yields acetone and oxalic acid (Lieben and Haitinger). Zwenger (1860) announced another acid, *chelidoninic acid*, believed by Walz to be succinic acid, and by Schmidt to correspond to ethylene-succinic acid. It is believed to be identical with the yellow acid produced by treating chelidonic acid with cold alkali in excess.

Chelerythrine may be obtained by forming a strong ethereal tincture of the celandine root; through this pass hydrochloric acid gas, and dry the precipitated chloride, which is insoluble in ether. Then dissolve it in hot water, filter, precipitate by ammonia, dry the precipitate, dissolve it in ether, decolorize by animal charcoal, again precipitate by hydrochloric acid gas, and decompose the chloride by ammonia, as before (see *Sanguinaria*). Three additional alkaloids, *protopine* and *alpha-* and *beta-homochelidonine*, have been isolated by Schmidt from the commercial alkaloids, chelidonine and chelerythrine. The alkaloid, *chelidonine*, was found by this author identical with *stylophorine*, an alkaloid obtainable from the root of Stylophorum diphyllum, an observation confirmed by Selle (*Amer. Jour. Pharm.*, 1890).

Action, Medical Uses, and Dosage.—Stimulant, acrid, alterative, diuretic, diaphoretic, purgative, and vulnerary. As a drastic hydragogue it is fully equal to gamboge. The juice, when applied to the skin, produces inflammation, and even vesication, and has long been known as a caustic for the removal of *warts;* also applied to *indolent ulcers*, *fungous growths*, etc., and is useful in removing *specks* and *opacities of the cornea*, and in curing *ringworms*. Celandine is superior to arnica as a vulnerary; an alcoholic tincture of the root (3 ounces to 1 pint), will be found an unrivaled external application to prevent or subdue *traumatic inflammations*. Used internally in decoction or tincture, and externally in poultice or ointment, for *scrofula*, *cutaneous diseases*, and *piles*. Likewise useful in *hepatic affections*, and is supposed to exert a special influence on the spleen. It is a remedy influencing the parts supplied with nerve force from the branches of the solar plexus, and with blood from the hepatic artery, and to some extent by the splenic artery. Both acute and subacute forms of *inflammation of the liver*, when suppurative action has not set in, are benefited by chelidonium. *Migraine*, *bilious headaches*, *supraorbital neuralgia*, *bilious dyspepsia*, with headache, and other gastric and intestinal disturbances, due to faulty action of the liver, are well treated with it. It is a remedy for so-called "*liver coughs*." *Hemorrhoids*, *hepatic* and *splenic congestion*, and *gastro-intestinal disorders*, due to capillary engorgement of the viscera, are conditions for its exhibition. It is one of the best of remedies for *biliary catarrh*, the result of hepatic congestion, and for *jaundice*, due to obstruction of the bile ducts, the mucous membranes of which are swollen from the subacute inflammation present. Full, tensive, or throbbing pain in the right hypochondrium, and pain extending to beneath the right scapula, are the guides to its use in these hepatic disorders. Prof. Scudder, who conceived a very favorable opinion of this remedy, favored the use of small doses of chelidonium where the tongue was somewhat pallid and enlarged, the skin sallow, full, and occasionally tinged greenish-yellow, the mucous membranes enfeebled and full, right hypochondrium full, abdomen tumid, feces light in color, and urine of high specific gravity, and pale, but cloudy. As a rule there is no general abdominal pain. Œdema of the extremities is sometimes an added indication. The remedy has acted favorably in *biliary calculi*, and in the small dose ($\frac{1}{20}$ to $\frac{1}{10}$ drop, every 2 or 3 hours) the extravagant claim of having radically cured *hydrocele*, has been made by some leading Homœopaths. Dose of the powdered root, from $\frac{1}{2}$ to 1 drachm; of the fresh juice, from 30 to 40 drops, in some bland liquid; of the tincture, from 1 to 2 fluid drachms; of the aqueous extract, from 5 to 10 grains. The foregoing doses represent its gross action, but for the specific purposes for which it is now employed, the dose should be small, preferably from 1 to 15 drops of specific chelidonium. Prof. Scudder preferred it as follows: Specific chelidonium, gtt. x; aqua, fl℥iv. Mix. A tablespoonful every 3 or 4 hours.

Specific Indications and Uses.—"Full, pale, sallow tongue and mucous membranes; skin pale and sallow, sometimes greenish;" hepatic congestion; jaundice, due to swollen bile ducts; sluggish hepatic action; cough, with hepatic pain; fullness, with tensive or throbbing pain in the right hypochondrium, and pain extending to right shoulder; melancholia, headaches, and gastric disorders, dependent upon faulty action of the liver.

Related Species.—*Glaucium luteum*, Scopoli (*Chelidonium Glaucium*, Linné). Europe. Naturalized in the United States. *Horn poppy.* Grows near the coast and has yellow flowers. Resembles celandine somewhat, though possessing less acridity, has a saffron-yellow juice, and contains *sanguinarine*, *glaucine* (in the herb), and *glauco-picrine* (in the root), all white alkaloids. Narcotic and poisonous, occasioning delirium and visual disturbances, objects appearing yellow. The juice, mixed with egg albumen, has been used domestically in Provence for *piles* and *spasmodic anal stricture*, and the juice applied for *stings*, *contusions*, *ulcers*, etc.

Glaucium corniculatum, Curtius.—Similar to above plant, but has red flowers marked with a black spot at the base of the petals.

CHELONE.—BALMONY.

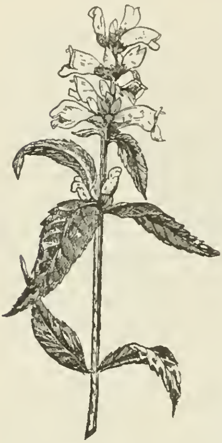
The herb, and especially the leaves of *Chelone glabra*, Linné.

Nat. Ord.—Scrophulariaceæ.

COMMON NAMES: *Balmony*, *Snakehead*, *Turtlehead*, *Turtlebloom*, *Shellflower*, *Saltrheum weed*.

Botanical Source.—This is a perennial, smooth, herbaceous plant, with a simple, erect, somewhat 4-sided stem, about 2 or 3 feet high. The leaves are opposite, sessile, or nearly so, smooth, oblong-lanceolate, acuminate, serrate, and of a dark, shining green above. The flowers are large, inodorous, white, rose color, or purple, subsessile, in a short, terminal, dense spike, somewhat resembling the head of a snake or tortoise; the corolla is inflated, bilabiate, and contracted at the mouth; the upper lip is broad and arched, and keeled in the middle; the lower one woolly within; the calyx is deeply 5-parted, with 3 bracts at the base. Stamens 4, with hairy filaments and hairy, cordate anthers, a fifth sterile filament smaller than the others; ovary ovate; style long, exsert, and bending downward. The fruit is an oval, 2-celled, 2-valved capsule, with many small, wing-margined seeds (W.—G.).

Fig. 68



Chelone glabra

History.—This valuable medicinal plant is found in the United States in damp soils, flowering in August and September. The flowers are very ornamental, and vary in color, according to the variety of the plant, there being many varieties. The leaves are exceedingly bitter, but inodorous, and communicate their properties to both water and alcohol.

Chemical Composition.—W. Pfeuffer (1892), who made an approximate analysis of the over-ground portion of this herb, detected in the alcoholic and ethereal extracts, a glucosid, which, when decomposed, evolved a peculiar, disagreeable odor. The usual plant constituents were found, and from the ethereal extract crystals giving the reactions for gallic acid were obtained (*A. P. A. Proc.*, 1892).

Action, Medical Uses, and Dosage.—Tonic, cathartic, and anthelmintic. Especially valuable in *jaundice* and *hepatic diseases*, likewise for the removal of *worms*, for which it may be used in powder or decoction, internally and also in injection. Used as a tonic in small doses, in *dyspepsia*, *debility of the digestive organs*, particularly when associated with hepatic inactivity, and during convalescence from *febrile* and *inflammatory diseases*. It is valuable after *malarial fevers* as a tonic and to unlock the secretions when checked by quinine. Recommended in form of ointment as an application to painful and inflamed *tumors*, irritable and painful *ulcers*, *inflamed breasts*, *piles*, etc. Dose of the powder, 1 drachm; of the tincture, 1 or 2 fluid drachms; of the decoction, 1 or 2 fluid ounces; specific chelone, 10 to 30 drops.

Specific Indications and Uses.—Gastro-intestinal debility, with hepatic torpor or jaundice; worms.

CHENOPODIUM (U. S. P.)—CHENOPODIUM.

"The fruit of *Chenopodium ambrosioides*, Linné, and variety *anthelminticum*, Gray"—(*U. S. P.*).

Nat. Ord.—Chenopodiaceæ

Common Names: *American wormseed*, *Wormseed*.

Botanical Source.—This plant, sometimes known also by the name of *Jerusalem oak*, has a perennial and branched root, with an erect, herbaceous, much-branched, furrowed stem, rising from 1 to 3 feet in height. The leaves are alternate or scattered, oblong-lanceolate, toothed, sinuate, nearly sessile, distinctly veined, attenuated at both ends, of a yellowish-green color, and marked beneath with small resinous atoms. The flowers are very numerous, small, of the same color as the leaves, arranged in long, slender, axillary, or terminal, *leafless* racemes; calyx with 5 ovate, concave, permanent segments; stamens 5, opposite to the segments of the calyx, and about as long, with awl-shaped filaments; styles 2 or 3, short; ovary orbicular, depressed; seeds solitary, lenticular, crustaceous, and covered by the permanent, 5-angled calyx (L.).

History and Chemical Composition.—Chenopodium is found growing in waste places in almost all parts of the United States, flowering from July to September, and ripening its seeds throughout the autumn, at which time they should be collected. The whole plant has a strong, unpleasant odor, which is owing to its essential oil (see *Oleum Chenopodii*). When first obtained, it is of a light straw color, but gradually acquires a darker hue. The seeds contain a large quantity of this oil, which is obtained from them by distillation. The whole plant is occasionally employed, but the seeds only are official. *Chenopodin* has been obtained from the fresh plant, in the form of a white, tasteless, inodorous powder, soluble in 11 parts of water, 202 parts of cold alcohol, and soluble in diluted acids.

Description.—"Nearly 2 Mm. ($\frac{1}{12}$ inch) in diameter, depressed-globular, glandular, dull-greenish or brownish, the integuments friable, and containing a lenticular, obtusely-edged, glossy, black seed. It has a peculiar, somewhat terebinthinate odor, and a bitterish, pungent taste"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Anthelmintic and antispasmodic. It is used in various forms, as the expressed juice, electuary, or decoction, to expel the *lumbrici* in children. The dose of the juice is a tablespoonful, repeated night and morning; of the infusion, prepared by infusing 1 ounce of the recent plant in 1 pint of milk, with the addition of some aromatic, a wineglassful; of the electuary, made by thoroughly mixing the pulverized seed in honey or syrup, 20 or 40 grains. But the essential oil, on which the vermifuge properties depend is the best form, and is more generally employed. Its dose is from 4 to 8 drops mixed with sugar, or in emulsion, to be given morning and evening, for 4 or 5 days successively, and then, as with the other forms of administration, it should always be followed by a purgative. It is used in various combinations. Take of oil of wormseed and tansy, of each 1 ounce, spirits of turpentine 1½ ounces, castor oil 1 pound. Mix. Dose, for a child, a teaspoonful every hour, until it operates; for an adult, a tablespoonful. Equal parts of chenopodium and jalap in decoction may be given in tablespoonful doses, on an empty stomach, 4 or 5 times a day. The oil has likewise been reputed beneficial in *amenorrhœa*.

Specific Indication and Use.—To expel lumbricoid worms.

Related Species.—The *Chenopodium ambrosioides*, Linné, which has been successfully used in *chorea*, and the *Chenopodium botrys*, Linné, which has been used with advantage in *catarrh* and *humoral asthma*, as an expectorant, are both indigenous, and though less powerful, possess somewhat similar properties; and, indeed, from the superior powers of the *C. anthelminticum*, it might possibly be found of more benefit in these affections than the above. The first species is official in many of the European countries where it is known as *Herba botryos mexicanæ* or *Mexican tea*. It is plentiful in our middle states. Its flower-spikes are dense and *leafy*. The second species is strongly aromatic, the odor resembling turpentine, and is known as *Oak of Jerusalem* and *Feather geranium*. It is naturalized in this country, being a native of Europe and Asia.

Chenopodium album, Linnè, is *Common pigweed* or *Lamb's-quarter*. It is a mealy, smooth plant, having a saline, mucilaginous taste.

Chenopodium Bonus-Henricus, Linné. A somewhat mealy plant, having a saline, mucilaginous taste; a native of Europe, but naturalized in America and known in Europe as *Good King Henry*. It is a domestic application for *pain*, and is reputed antispasmodic and expectorant.

Chenopodium vulvaria, Linné. A mealy plant of Central Europe, having the smell of fish brine on account of the trimethylamine it contains. It is known as *Fetid goosefoot*, and employed in Europe, both locally and internally, in many *nervous disorders*.

Chenopodium quinoa.—Cultivated in Chili and Peru for its seeds, which yield a flour resembling oatmeal. The seeds contain 11 per cent of albumen and other protein matter, 5 per cent of sugar, 7.5 per cent of casein, and 40 per cent of starch. A bitter principle has been isolated from the variety known as *red quinoa*, and this variety has been employed as an antiperiodic and emetic.

CHIMAPHILA (U. S. P.)—CHIMAPHILA.

"The leaves of *Chimaphila umbellata* (Linné), Nuttall"—(*U. S. P.*); (*Chimaphila corymbosa*, Pursh; *Pyrola umbellata*, Linné). The whole plant may be employed.

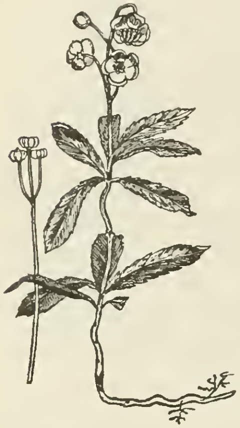
Nat. Ord.—Ericaceæ.

COMMON NAMES: *Pipsissewa, Prince's pine, Ground holly, Wintergreen.*

ILLUSTRATIONS: Bentley and Trimen, *Med. Plants*, 165; Bigelow *Med. Bot.*, Vol. II, 21.

Botanical Source.—This plant is a small evergreen, nearly herbaceous, perennial herb, with a creeping, yellowish rhizome, from which are sent several simple, erect, or semi-procumbent stems, somewhat angular, marked with the scars of former leaves, and woody at their base; they grow from 4 to 8 inches in height. The leaves are in two or more irregular whorls, from 2 to 3 inches long, about one-fourth as wide, cuneate-lanceolate, acute at the base, sharply serrate, on short petioles, coriaceous, shining, of a uniform dark-green color, paler below, and not spotted. The flowers are corymbose, nodding, of a light-purple color. The pedicels, with linear-subulate bracts about their middle, 8 lines long. The calyx is small, consisting of 5 roundish, acute teeth, or segments, and much shorter than the corolla. The corolla is composed of 5 roundish, concave, spreading, cream-colored petals, exhaling a fragrant odor, and tinged at the base with purple. Stamens 10, hypogynous; filaments sigmoid, the lower half fleshy, triangular, dilated, slightly pubescent at the edges; the upper half filiform. Anthers 2-celled, each cell opening by a short, round, tubular orifice, which points downward in the bud, but upward in the flower. Pollen white; ovary globular, depressed, furrowed, obscurely 5-lobed, with a funnel-shaped cavity at the top, and supporting a large peltate, convex, obscurely 5-rayed stigma. Style short, straight, half as long as the ovary, inversely conical, inserted in the cavity of the ovary, and concealed by the stigma. The capsule is erect, depressed, 5-celled, 5-valved, with partitions from the middle of the valves. The seeds are numerous, linear, and chaffy (L.—W.—G.).

Fig. 69.



Chimaphila umbellata.

History.—This little herb is indigenous to the north temperate regions of both hemispheres, and is met with in the United States in dry, shady woods, flowering from May to August. The leaves have no odor when dried, but when fresh and rubbed they are rather fragrant; their taste is astringent, sweetish, and not disagreeably bitter. The whole herb is used. Boiling water or alcohol extracts the active properties.

Description and Chemical Composition.—"About 5 Cm. (2 inches) long, oblanceolate, sharply serrate above, wedge-shaped and nearly entire towards the base; coriaceous, smooth, and dark-green on the upper surface. It is nearly inodorous, and has an astringent and bitterish taste"—(*U. S. P.*). Mr. S. Fairbank found the leaves to contain gum, tannic acid, starch, pectic acid, extractive, resin, fatty matter, chlorophyll, yellow coloring matter, lignin, and golden-yellow, needle-shaped crystals, which he named *chimaphilin*. This yellow body is without taste or odor, freely soluble in alcohol, chloroform, ether, benzol, benzin, glacial acetic acid, and acetone, and in oils, both essential and fixed, but dissolves sparingly in water. It has a neutral reaction, and is volatile with aqueous vapors. *Arbutin* ($C_{24}H_{32}O_{14}.H_2O$), a crystalline, glucosidal principle, found also in other ericaceous plants, forming neutral, silky, colorless, bitter needles, and readily soluble in boiling water and alcohol, but sparingly so in ether, was found in this plant by Zwenger and Himmelmann, in 1864. Salts of potassium, calcium, iron, magnesium, chloride of sodium, phosphoric, sulphuric, and silicic acids were also found (*Jour. Trans. Md. Col. Pharm.*, March, 1860). Mr. E. S. Beshore (1887) also obtained chimaphilin, and found another crystalline body, of the composition $C_{10}H_{19}O$, melting at 236° C. (457.2° F.), by abstracting the dried drug with petroleum ether.

Mr. J. C. Peacock (*Amer. Jour. Pharm.*, 1892) failed to obtain chimaphilin from the fresh plant of *Chimaphila maculata*, but obtained it in the ordinary way from the dried plant, by distilling the drug with water. The influence of drying upon the yield of *chimaphilin* from *C. maculata* was likewise observed by him when attempting to abstract this substance by means of petroleum ether. Mr. Peacock found the fusing point of chimaphilin at 113 to 114° C. (235.4° to 237.2° F.), and the composition of this substance to correspond with the formula $C_{24}H_{21}O_4$. Three other principles of a crystalline character were obtained from chimaphila, occurring respectively as "matted crystals," "tufted crystals," and "glistening crystals," all differing in solubility and other respects from any previously known constituents of the order Ericaceæ (*A. P. A. Proc.*, 1892). In 1895, Mr. Ridenour confirmed Mr. Peacock's formula by the analysis of chimaphilin and some new derivatives prepared by him; he succeeded, however, in obtaining chimaphilin from the fresh plant of *C. maculata*.

Action, Medical Uses, and Dosage.—Diuretic, tonic, alterative, and astringent. The fresh leaves, when bruised and applied to the skin, act as vesicants and rubefacients. Its alterative properties are marked, the processes of waste and nutrition being powerfully influenced by it. It is especially useful in *scrofula* and *chronic rheumatic* and *nephritic affections*. Irritation of any part of the urinary tract is relieved by it, and the circulation and nutrition of the part improved. The cases of all diseases in which it is of most value are those of debility, and particularly when a scrofulous taint is present. Its particular field is in *genito-urinary fluxes*, due to debility or depending upon a scrofulous diathesis. The more pronounced the catarrhal character of the disorder, the more valuable is the drug. *Catarrh of the bladder*, with offensive urine, or urine loaded with mucus, muco-pus, or even blood, are cases for its exhibition. Chronic affections of the kidneys, with muco-purulent discharges, are also conditions indicating it. The infusion is the best preparation. Do not make a decoction, as boiling impairs its virtues. It is also a remedy for *chronic prostatic irritation* and *chronic prostatitis*. Used both locally and internally, it is a good remedy for *scrofulous ulcerations*. The infusion has cured *ascites*, and has been advantageous in *strangury*, *chronic gonorrhœa*, and other *mucous profluvia;* and as an antilithic it is said to diminish lithic acid in the urine. In *dropsy* it can not be depended upon without the use of other more active measures, and is better adapted to cases accompanied with weakness and loss of appetite. In urinary disorders, it may be used as a substitute for uva ursi and buchu, to which it is preferable on account of being less obnoxious to the stomach. In many cutaneous diseases it has proved very efficient. Dose of the infusion, from 1 to 4 fluid ounces, 3 times a day; of the extract, from 10 to 20 grains, 3 or 4 times a day; a syrup may be prepared by macerating 4 ounces of the finely-bruised leaves in 8 fluid ounces of water for 36 hours, then subject the whole to percolation till a pint of fluid is obtained, evaporate to ½ pint, and add 12 ounces of sugar. Dose, 1 or 2 tablespoonfuls; fluid extract, ʒss to ʒj, largely diluted; specific chimaphila, 5 drops to 1 drachm, every 3 or 4 hours.

Specific Indications and Uses.—Atonic and debilitated states of the urinary organs, giving rise to lingering disorders, with scanty urine, but excessive voidings of mucus, muco-pus, or bloody muco-pus, offensive or non-offensive in character; smarting or burning pain with dysuria; chronic irritation of the urethra and prostate; chronic relaxation of the bladder walls; chronic prostatitis, with vesical catarrh.

Related Species and Drugs.—*Chimaphila maculata*, Pursh, *Spotted wintergreen*, may be known from the above by its leaves, which are opposite, or in threes, lanceolate, acuminate, rounded at the base, where they are broader than near the summit, remotely serrate, of a deep olive-green color, and veined with greenish-white. The *C. umbellata* leaves are broader near the summit, tapering toward the base, of a uniform shining-green color, serrated, and not marked with the whitish line along the mid-vein and veinlets. The *C. maculata* is probably possessed of similar powers with the official article, and may be used as a substitute. An extract of it is reputed to have cured *epilepsy*.

Pyrola rotundifolia, Linné; *Pyrola chlorantha*, Swartz; *Pyrola elliptica*, Nuttall; *Pyrola secunda*, Linné (see *Pyrola*).

Orthosiphon stamineus. *Java tea*.—This drug comes in the form of little oval, green leaves, finely toothed, and rolled like ordinary tea. Essential oil and a glucosid, *orthosiphonin* in crystals, are among its constituents. It is reputed powerfully diuretic, and, in doses of from 15 to 20 grains per day, it has been lauded in *uric acid diathesis*, *gravel*, *ascites*, and *nephritic colic*.

CHINOIDINUM.—CHINOIDINE.

Synonyms: *Chinioidinum*, *Chinoidina*, *Quinoidine*, *Quinoidina*, *Chinoidin*, *Quinoidin*, *Amorphous quinine*, *Precipitated extract of bark*.

History and Chemical Composition.—*Chinoidine* is a non-crystallizable alkaloid occurring in the mother liquors resulting from the manufacture of cinchona alkaloids. The name *chinoidine* (quinoidine), was first given by Sertürner to what he believed to be a new alkaloid, from cinchona barks, which, however, turned out to be a mixture of quinoidine and cinchonine, intermixed with a yellowish body that prevented crystallization. Liebig, after depriving quinoidine of its crystallizable admixtures, thought it to be amorphous quinine, rendered non-crystallizable through the application of heat.

The chief constituents of commercial chinoidine of the present time are *diconchinine* ($C_{40}H_{46}N_4O_3$), when obtained from barks containing quinine and quinoidine in abundance, or *dicinchonine* ($C_{38}H_{44}N_4O_2$), when barks predominating in cinchonine or cinchonidine are manipulated. These two bodies are amorphous and not easily separable.

Description and Tests.—Commercial chinoidine usually appears in rolls or masses, of a brownish-black or almost black color, and when cold breaks with a resin-like, shining fracture. It is odorless, feebly bitter, and blues litmus paper. When warmed it becomes plastic and in the heat of summer it gradually takes the shape of the container. Water scarcely dissolves it; ether and benzene partially, and alcohol, chloroform, and diluted acids freely dissolve it. These solutions are extremely bitter, and exhibit right-hand polarization. After triturating chinoidine with boiling water and filtering the fluid which should then be transparent and colorless, it should remain so upon the addition of an alkali, thus showing the absence of alkaloidal salts. Not more than 0.7 per cent of ash should be left upon incineration.

Action, Medical Uses, and Dosage.—Chinoidine was introduced as a remedy for *malarial manifestations*, and is considered by many superior in some respects to quinine. It is slower to act, and the dose required is from ½ to 2 times greater than that of quinine sulphate. It is claimed for it that it is equal in efficiency to the latter in *simple malarial intermittents*, and may be given before and during the chill without unpleasant results, and it never causes aural tinnitus. In *chronic malarial disorders* it is asserted that its power is greater than that of quinine, and persons toxically impressed with the latter may take chinoidine without unpleasant consequences, and with therapeutical benefit. Lastly, in *malarial rheumatism*, *masked malaria*, and as a tonic, it is regarded by some as far more effective than the quinine salts. It is undoubtedly valuable in *malarial cachexia*, and has the advantage of having but slight taste. If desired it may be given in sweetened, strong coffee. Dose for adults, 7 to 15 grains; for young children, 2 or 3 grains.

Related Preparations.—TINCTURA CHINOIDINI.—*Tincture of chinoidine* of the *German Pharmacopœia*, is prepared by dissolving the ingredients in the following proportions: Chinoidine (2 parts), in hydrochloric acid (1 part), and alcohol, sp. gr. 0.894 (17 parts). It is transparent in thin portions, dark brown in bulk, and excessively bitter. An equal measure of water and ammonia water precipitates the chinoidine from the tincture, causing the liquid to assume a yellowish color.

CHINOIDINI HYDROCHLORAS.—*Chinoidine hydrochloride* is a hygroscopic yellow or brownish-yellow powder produced by saturating with chinoidine warmed diluted hydrochloric acid, filtering, and condensing by evaporation.

CHINOIDINI CITRAS.—*Chinoidine citrate.* Transparent, soluble, reddish-brown scales, produced by dissolving chinoidine in a solution of citric acid in water, and evaporating to dryness.

CHINOIDINI TANNAS.—*Chinoidine tannate.* This is a yellowish-brown powder produced by mixing tincture of chinoidine (see above), diluted with water, and an aqueous solution of tannin, and lastly adding solution of acetate of ammonium. After several hours the precipitate is washed and dried at a heat not higher than 30° C. (86° F.). Its solution in water and hydrochloric acid is deep-yellow in color.

CHINOIDINI BORAS.—*Chinoidine borate.* Take chinoidine 10 parts, boric acid 5 parts, and water 100 parts. Heat to the boiling point, and filter through moistened cotton. Again heat the clear fluid to the boiling point, filter out the resinous portion, and continue this filtration and boiling until resinous matter no longer separates. Evaporate to 10 parts, set aside a half day, at a temperature not above 15° C. (59° F.). Now filter it from the acid and evaporate, when either transparent, brownish-yellow scales, or a yellowish powder will form. This has an alkaline reaction, is somewhat hygroscopic, is bitter to taste, and with water (3 parts), it produces a deep-yellow, clear solution, but with a greater amount of water (10 parts), the solution becomes turbid on boiling, and clear again upon cooling.

CHINOLINA.—QUINOLINE.

FORMULA: C_9H_7N. MOLECULAR WEIGHT: 128.74.

SYNONYM: *Leucoline.*

History and Preparation.—Quinoline is an artificial alkaloidal body obtained in the destructive distillation of quinine (or of cinchonine), with caustic potash. In 1842, by distilling quinine with potassium hydroxide, Gerhardt obtained this body in an impure condition and named it *chinoleine*, though Runge had before (1834) obtained a similar body from coal-tar and named it *leucoline*. These two bodies are now understood to be identical. Quinoline was first obtained pure by Williams in 1855. Zd. Skraup, in 1887, published his fruitful method of obtaining quinoline, by which way it may also be produced on a large scale A mixture of strong sulphuric acid, glycerin, nitro-benzene, and aniline are heated carefully and gently to begin with, lest the reaction be too violent, and then water is added to dilute the mixture, which is then distilled in a current of steam to remove the nitro-benzene. Caustic soda is then added to the residue to alkalinity, and the quinoline thus liberated distilled with steam. The resulting product is fractionally distilled, dissolved in alcohol, and to this solution sulphuric acid is added, which precipitates an acid sulphate of quinoline. The yield is about three-fifths of the theoretical amount. By this process the sulphuric acid abstracts from glycerin the elements of water, converting it into acrolein, which then combines with aniline, the nitro-benzene acting as an oxidizer.

Description.—Pure quinoline is a mobile, oily liquid, colorless, or but feebly yellow, highly refractive, with a sharp, bitter taste, and a distinctive, aromatic odor. Its density is 1.084; its boiling point near 237° C. (458.6° F.). It is hygroscopic, and exposed in the damp it forms a hydrate ($C_9H_7N.1\frac{1}{2}H_2O.$), which, at 40° C. (104° F.), becomes clouded. Alcohol, chloroform, ether, and benzin readily dissolve it, hot water partially. Carbon disulphide and wood alcohol mixes with it in all amounts. It is quickly turned brown by air and light, but decolorization may be effected by agitating it with solid potassium hydroxide, and subsequently slowly rectifying it. At ordinary temperatures it volatilizes, the odor resembling that of bitter-almond oil. It may be converted to a crystalline mass by means of a refrigerating mixture. Resin and camphor are soluble in it. When treated with fuming sulphuric acid it is changed into quinoline-sulphonic acid; this when melted with potassium hydroxide, forms oxyquinoline (C_9H_6NOH). German quinoline is a variable product. When quinoline is acted upon by amyl iodide, and then, with potassa or soda, a yellowish-green body, *cyanine*, is obtained. Quinoline salts are mostly crystalline, odorless, and respond to alkaloidal tests; its mineral acid salts are extremely hygroscopic.

Action, Medical Uses, and Dosage.—This agent has not fulfilled the claims made for it when introduced into medicine. While it has some antiperiodic and antipyretic properties, rendering it occasionally successful in *periodical fevers*, its bad effects upon the stomach—nausea, vomiting, and disordered digestion—more than offset any of its better qualities. A 5 per cent solution has been used with asserted success as a solvent for the false membrane of *diphtheria*, but the preparation has now fallen into disuse for this purpose. The tartrate and salicylate are given in doses of from 7 to 15 grains. Quinoline preserves anatomical specimens, though it extracts all the coloring matter. The following preparation is suggested: Quinoline 5 parts, common salt 6 parts, glycerin 100 parts, water 900 parts.

Quinoline Salts and Related Compounds.—QUINOLINE TARTRATE.—A nearly white, micaceous powder, having a sharp taste and pungent odor, soluble in cold water (80 parts), alcohol (150 parts), and ether (300 parts). It fuses at 125° C. (257° F.).

QUINOLINE SALICYLATE.—A crystalline, white powder, easily soluble in alcohol, fatty oils, petrolatum, and ether, and less so in glycerin and water.

QUINOLINE HYDROCHLORATE.—Dissolves in alcohol, chloroform, and water, and is sublimable.

DIAPHTHERIN, *Oxyquinaseptol Oxychinaseptol* ($C_6H_4.SO_3H.OH.[NC_9H_6OH]_2$).—A bright, yellow, crystalline powder composed of oxyquinoline and aseptol. It is produced by combining 1 molecule of phenol-sulphonic acid with 2 of oxyquinoline (oxychinoline). Water and diluted alcohol readily dissolve it; alkalies and blood decompose it. It is claimed for it that it is a non-poisonous, non-caustic antiseptic, and in a 1 per cent solution is used upon wounds.

ANALGEN.—*Ortho-oxyethylana-monobenzoyl-amidoquinoline* ($C_{18}H_{16}N_2O_2$ or $C_9H_5N[OC_2H_5]NHCOC_6H_5$). This is a quinoline derivative prepared by a complicated method. It is a crystalline, white powder, soluble in alcohol, acids, and scarcely at all in cold, but more easily in hot water. It has been used in 15-grain doses to allay the pains of *rheumatism*. It is claimed to be antipyretic, antirheumatic, and analgesic. It colors the urine red.

OREXINE HYDROCHLORIDE.—*Phenyldihydroquinazoline hydrochloride* ($C_6H_4.NCH.CH_3NC_6H_5HCl.$), *Phenyldihydrochinazolin hydrochlorate*. A quinoline derivative of complex character, introduced in 1890 as a remarkable appetizer, stomachic, and digestive. It is either a white powder, or in needle crystals soluble in water (1 in 13), and alcohol, but not in ether. It is pungent and bitter to the taste. Upon the Schneiderian membrane it acts as a powerful irritant. The dose is from 4 to 8 grains, in wafers or capsules (not in pills), immediately followed by fluid to protect the gastric membrane from its irritant effects. It is said to increase the appetite, but reports concerning its value are much at variance. It is probably overrated. This compound is also known as *Orexin*.

Chinol.—*Chinoline monohypochlorite* ($C_9H_6N.ClO.$). An odorless, crystalline, white powder, practically insoluble in water, but quite freely dissolved by alcohol. Its taste is pungent, but not unpleasant. In doses of 3 to 5 grains it is employed as an analgesic and antipyretic, being applicable to cases in which antipyrin succeeds.

CHIONANTHUS.—FRINGE-TREE.

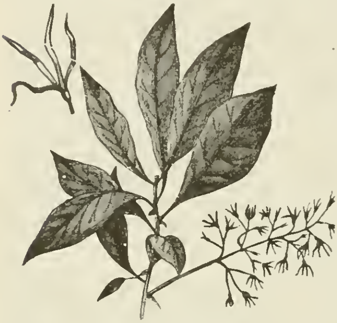
The bark of the root of *Chionanthus virginicus*, Linné.

Nat. Ord.—Oleaceæ.

Common Names: *Fringe-tree, Old man's beard, Snowdrop-tree.*

Botanical Source.—This shrub grows from 6 to 20 feet high, has oval or oblong, smooth, leathery leaves, opposite and veined. The flowers are in a dense, pendulous panicle, the pedicels being long, filiform, and single flowered. The calyx-tube is very short, persistent, 4-parted, and small. The corolla is about 1 inch long, consisting of 4 very narrow, drooping, linear, snow-white petals; hence the name fringe-tree, by which it is generally known. The style is short, the stigma notched. The fruit is an oval, purple, fleshy drupe, with a bloom, and contains a bony, one-seeded nut.

Fig. 70.



Chionanthus virginicus.

History.—Chionanthus is one of our most striking and beautiful southern shrubs, and is often cultivated in gardens and parks for its ornamental beauty. We regard it as one of our most valuable indigenous remedies. The fringe-tree, as it is commonly called, grows from Pennsylvania to Georgia and Tennessee, thriving in sandy soils, in elevated situations, near flat rocks, and along river banks. The tree, when in blossom (May and June), presents a beautiful appearance, being snow-white, hence its common names of *old man's beard, old man's gray beard, snowdrop-tree*, and *white ash*. It is also known as *poison ash*. The name chionanthus (pronounced kĭ-ō-năn″thŭs) is derived from two Greek words, *chion* (snow) and *anthus* (flower, or blossom), hence, snow-flower. The bark of the root is the part used, and imparts its properties to water or alcohol.

Action, Medical Uses, and Dosage.—Chionanthus acts principally upon the abdominal glandular organs, and to some extent upon the venous system, relieving congestion. It is an alterative in the Eclectic meaning of that term. While its main action is upon the visceral glands, especially the blood-making organs, its influence is also quite marked in other secretive structures. Besides its pronounced catalytic properties, it is diuretic, tonic, and is said to be aperient and narcotic. It is exceedingly doubtful if the latter statement be true and its aperient property, if it possesses such, is the result of its cholagogue action.

Prof. King, in former editions of the *American Dispensatory*, states that in *bilious* and *typhoid fevers*, as well as in *obstinate intermittents*, the infusion of the bark of the root is efficient. While the remedy is now but very little used for these conditions, still some "old school" authors, as well as some trade catalogues, seem to have appropriated the above statements in regard to its use. Prof. King further states that it is an excellent tonic in "convalescence from exhaustive diseases," and that it also proves a good local application in *external inflammations, ulcers* and *wounds*. The use of an infusion of the bark of the root is directed, still it is doubtful whether such a preparation would be as efficient as an alcoholic form, for the resin, or the resinoid, the active constituent of the drug, is insoluble in water. Goss states that the infusion is wholly inert. Chionanthus improves the appetite, aids digestion, promotes assimilation, and is a tonic to the whole system. It never produces catharsis, but ptyalism has resulted from its use.

Chionanthus has been successfully used in *mercurial cachexia*, *scrofula*, and *syphilis*, though we possess better agents for these classes of disease. Yet, if the patient be sallow, or yellow, and has hepatic pains, the remedy will prove a valuable accessory agent in hastening the cure.

It is for its prompt and efficient action in *hepatic derangements* that we most value fringe-tree preparations. If there is any one thing true in specific medicine, it is that chionanthus has a decidedly specific action in *jaundice*. The credit of having brought this remedy before the profession, for the purposes for which it is now used, belongs to the late Prof. I. J. M. Goss, of Georgia, who, in 1843, tested it on himself while suffering from an attack of *jaundice*, and reported the result in an eastern journal. Since then it has come to be the first remedy thought of for this complaint. Goss considered it the best remedy for all cases of jaundice, not dependent on gall stones. On the contrary, Prof. Scudder was high in his praise of it, even when *calculi* are present. He recommended it in 10 or 15-drop doses during the paroxysm, and also gave it to prevent a recurrence. Nux or dioscorea may be associated with it when called for, the former in atonic conditions, with broad, expressionless tongue, the latter in irritative states, the tongue being red, pointed, and elongated, with prominent papillæ. *Hypertrophy of the liver*, *chronic hepatic inflammation*, and *portal congestion* are speedily relieved by chionanthus. The remedy acts quickly, often removing in from 1 to 2 weeks, an icteric hue that has existed for months, and even years. Jaundice once cured by it is not apt to recur. There are two direct indications for the drug—jaundice, as evidenced by the yellowness of skin and conjunctiva; and soreness and pain, "hepatic colic," as pointed out by Prof. Scudder. The latter is by far the most direct indication. There is the dull, heavy pain in right hypochondrium, with a feeling of fullness and weight, deep-seated tenderness and soreness on pressure, occasional hectic flushes, light colored feces, sometimes diarrhœa with frothy, yeasty stools, and urine scanty and high colored.

These conditions, with the icteric hue of skin and conjunctiva, call for chionanthus. Sometimes the patient writhes in pain, can not find rest in any position. ℞ Specific chionanthus, gtt. x, every half hour, and apply a cloth wrung out of hot water. In *dyspepsia*, with hepatic complications; in *irritative states of the stomach* from "high living," and the use of alcoholic stimulants; and in general *chronic inflammatory conditions of the duodenum*, and *ductus communis choledochus*, chionanthus serves a useful purpose. It is also a good remedy in *infantile dyspepsia*. *Rheumatic affections*, with soreness in the region of the liver, and a jaundiced condition, are ameliorated by this drug. Its tonic effects on the chylopoietic viscera render it a good agent in *general debility*. In *intestinal dyspepsia*, with jaundice, thin, watery, yeasty alvine discharges, with previous abdominal distension: ℞ Specific chionanthus, gtt. v, every 2 hours.

Chronic splenitis and *nephritis* are conditions in which fringe-tree often proves a good remedy; also in *pancreatic disease*, inflammatory or otherwise. *Glandular diseases*, with evidence of imperfect waste, often call for its administration. Chionanthus is of utility in *uterine* and *ovarian congestion*, when the usual hepatic symptoms calling for it are present. If there be fullness and bearing down in the pelvic viscera, especially a desire to frequently evacuate the rectum, combine it with specific helonias. ℞ Specific chionanthus, specific helonias, aa fl℥j; aqua q. s., ℥iv. Mix. Sig. Teaspoonful every 2 hours.

In female disorders it may also be combined with gelsemium, macrotys, or pulsatilla, when indications for these drugs are present. Some cases of uterine *leucorrhœa* are promptly benefited by it. Cleansing injections should be employed at the same time. As a poultice it will be found an excellent local application in external *inflammations*, *ulcers*, and *wounds*.

Dose, from ½ fluid ounce of the infusion to 2 fluid ounces, repeated several times a day, according to its influence upon the system. The usual dose of specific chionanthus (the best preparation), is 10 drops in water every 3 hours. Chionanthin, the so-called concentration, is of little value and is but seldom used. It was first prepared by Prof. Goss.

Specific Indications and Uses.—Dirty, sallow skin, with expressionless eyes and hepatic tenderness; an icteric hue, with or without pain; hepatic colic; intense pain from liver to umbilicus, attended with nausea and vomiting and great prostration; pain in epigastrium and right hypochondrium, simulating colic, sometimes extending to the abdomen; jaundice, with itching skin and thin, light-colored, watery stools; tympanites; colic, with green alvine discharges; urine stains the clothing yellow.

CHIRATA (U. S. P.)—CHIRATA.

"The entire plant, *Swertia Chirata*, Hamilton"—(*U. S. P.*). (*Ophelia Chirata*, Grisebach; *Agathotes Chirayta*, Don; *Gentiana Chirayta*, Roxburgh.

Nat. Ord.—Gentianeæ.

COMMON NAMES: *Chirata*, *Chiretta* (*U. S. P.*, 1870), *Chirayta*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 183.

Botanical Source.—Chirata is an annual, with a branched root, and a smooth, erect stem, about 2 or 3 feet high, the middle and lower portion being round, the upper 4-angled, with a prominent decurrent line at each angle. The branches form panicles, the leaves being lanceolate, or ovate-acuminate, and cordate at the base, smooth, entire, acute, sessile, clasping, and marked with 3, 5, or 7 nerves. The flowers are yellow, rotate, 4-parted, numerous, and peduncled. The stamens are 4, the style single, and the stigma 2-lobed. The fruit is a many-seeded capsule.

History and Description.—This annual plant is a native of North India, growing in the mountainous districts, and has been held in considerable esteem as a medicine by the Hindus. The whole plant is gathered about the flowering period, or just as the capsules have fully formed (*Pharmacographia*). The whole plant, including the flowers, is very bitter, with the exception of the woody portions of the stouter stems. The *U. S. P.* thus describes the medicinal article: "Root nearly simple, about 7 Cm. (2¾ inches) long; stem branched, nearly 1 meter (about 40 inches) long, slightly quadrangular above; containing a narrow wood-circle and a large, yellowish pith. Leaves opposite, sessile, ovate, entire, 5-nerved. Flowers numerous, small, with a 4-lobed calyx and corolla. The whole plant smooth, pale-brown, inodorous, and intensely bitter"—(*U. S. P.*).

Chemical Composition.—The ash of chirata yields carbonates and phosphates of calcium, potassium, and magnesium. Tannin is almost entirely absent. A crystalline, yellow, waxy body in small amount, as well as the ordinary plant constituents, abound. Two bitter principles occur, discovered by Höhn in 1869. These bodies are *ophelic acid* ($C_{13}H_{20}O_{10}$), and *chiratin* ($C_{26}H_{48}O_{15}$), the former being in largest amount. *Ophelic acid* is a hygroscopic, non-crystalline, yellow, viscid body, having an odor faintly suggestive of gentian, and an acidulous, bitter taste which is persistent. Water, ether, and alcohol dissolve it. Basic lead acetate precipitates it yellow. *Chiratin* forms an insoluble compound with tannic acid (ophelic acid does not), and may be removed by means of that acid. It is a pale-yellow, indistinctly crystalline powder. Alcohol, ether, and warm water dissolve it, and yet, though hygroscopic, it is not readily soluble in cold water. Its taste is extremely bitter, and its behavior to litmus neutral. Boiled with hydrochloric acid it splits into *ophelic acid*, water, and *chiratogenin* ($C_{13}H_{24}O_3$), a bitter, amorphous, brown body, not soluble in water, but freely so in alcohol. It is unaffected by tannin.

Substitutes and Adulterants.—Several species of Ophelia and related plants go by the name of *chirata* in India. These are designated by the natives as hill (*puharee*) chirata, sweet (*meetha*) chirata, purple (*ooda*) chirata, and southern (*dukhunee*) chirata. *Chota chiretta*, or *small chiretta* is the product of *Slevogtia orientalis*, Grisebach. The species of Ophelia referred to above are the *O. angustifolia*, Don (less bitter than chirata); *O. elegans*, Wight; *O. densifolia*, Grisebach; *O. multiflora*, Dalz; *O. pulchella*, Don. These all possess, more or less, the bitter tonic virtues of chirata. Besides these are included *Andrographis paniculata*, Wallich, and a few species of *Exacum* (*Pharmacographia*).

Action, Medical Uses, and Dosage.—This drug possesses the tonic properties of gentian and similar bitters. It is valued in Hindustan, where it is much employed in *urinary complaints* with uneasiness in the region of the kidneys, frequent urging to urinate, which is accomplished with difficulty, and in cases of *uric acid deposits.* It is a remedy also for convalescence from exhausting sickness, and for atonic and nervous forms of *dyspepsia.* Dose of chirata, 10 to 20 grains; fluid extract, 10 to 20 minims; infusion (℥ss to boiling water Oj), fl℥i to fl℥ii, 3 times a day.

CHLORAL (U. S. P.)—CHLORAL.

FORMULA: Chloral, C_2Cl_3OH. MOLECULAR WEIGHT: 147.01.

FORMULA: Chloral hydrate (CHLORAL, *U. S. P.*), $C_2HCl_3O + H_2O$. MOLECULAR WEIGHT: 164.97.

SYNONYMS: *Aldehydum trichloratum*, *Hydrous chloral*, *Chloral hydrate*, *Trichloraldehyde hydrate.*

History and Formation.—Chloral, the anhydrous compound (for the hydrate or *U. S. P.* chloral, see below) was discovered in the year 1832, by Liebig (Gmelin's *Chemistry*, Vol. IX), who obtained it by passing chlorine through absolute alcohol. In 1845, Staedeler procured it by the action of nascent chlorine upon various organic substances, and also by the distillation of starch, binoxide of manganese, and hydrochloric acid. It excited but little interest until the year 1869 (*Pharm. Jour.*, 1869, p. 150), at which period hydrate of chloral was introduced to the medical profession by Dr. Oscar Liebreich, of Berlin. Shortly afterward, in the same year, both Mr. Hanbury and Dr. Richardson brought specimens before the English Medical and Therapeutical Associations, and subsequently its introduction to other countries soon followed. Many long names have been given to it by chemists, as *aldehyde of trichlorated acetic acid*, *trichloraldehyd*, *trichlormethyl-hydrocarbonoxyd*, *trichloracetyloxydhydrat*, but which have not been and are not likely to be adopted by physicians.

Preparation and Description.—Chloral occurs as a colorless fluid, oily in appearance, and of the specific gravity 1.518, at 0° C. (32° F.), and 1.502, at 18° C. (64.4° F.). Its boiling point is about 99° C. (210.2° F.). At ordinary temperatures it evolves a pungent vapor that is very irritating to the eyes. It has a disagreeable taste, is soluble in less than its weight of water, and in 4 times its weight of chloroform, and is freely miscible with ether. Chloral dissolves phosphorus, sulphur, bromine, and iodine, the latter solution giving a very rich purple color. Heat facilitates their solution. Anhydrous metallic oxides have no action upon it. It unites with water to form a hydrate, and with alcohol to form an alcoholate. The formula for chloral is C_2Cl_3OH, and its modern name is *Trichloraldehyde.* It is made by passing chlorine gas into anhydrous alcohol. The word *chloral* is derived from the first syllables of chlorine and alcohol (*chlor*[ine] *al*[cohol]) (a similar word-creation is *aldehyd*).

The reaction which produces chloral is very complex. (For a lucid exposition of the reactions involved see Attfield's *Chemistry*, 1894). In practice, it is customary to first reduce the temperature of the alcohol through which the chlorine passes, then, as the solution thickens, to apply heat until hydrochloric acid gas ceases to be evolved and chlorine appears, when the flow of chlorine is discontinued. The crude chloral alcoholate, together with other incidental products of the reaction, is now agitated with sulphuric acid, and then distilled; it is now purified, by again distilling it, from a small portion of quicklime, being careful not to have an excess of lime, or the chloral will be destroyed. Chloral is decomposed by solutions of caustic alkalies, yielding a formate of the base, and chloroform, and it is thought by some, that to this decomposition of chloral in the alkaline fluids of the body, gradually producing chloroform, its influence upon the system is due. It is not employed in medicine, and is of interest only from the fact that it unites with one molecule of water to form chloral hydrate.

Chloral can be distilled unchanged, but gradually becomes thicker, and occasionally changes into an insoluble modification with development of heat; this modification presents a porcelain-like mass, termed *metachloral*, which, though isomeric with the fluid chloral, is insoluble in water, alcohol, or ether, but which is reconverted into chloral by distillation; contact with water gradually changes it into the crystallized hydrate of choral. The aqueous solution of chloral has no action upon vegetable colors; oxides of silver or mercury do not affect it; concentrated sulphuric acid deprives it of water and separates the anhydrous crystals. The foregoing chloral must not be confused with the official preparation, which is chloral hydrate, and now passes under the name CHLORAL (*U. S. P.*).

CHLORAL (*U. S. P.*). CHLORAL HYDRATE.—*Hydrate of chloral. Preparation:* Chloral hydrate ($C_2Cl_3H_3O_2$, or $C_2Cl_3OHH_2O$, or according to *U. S. P.*, $C_2HCl_3O+H_2O$) is prepared by mixing chloral with the proper amount of water, and then pouring the solution, in thin layers, into a porcelain or glass dish; this is covered and placed in a cool situation. Heat is liberated, and the liquid solidifies, forming a mass of pure dazzling whiteness, composed of minute, transparent, or semi-transparent crystals, or crystalline plates of chloral hydrate. These have a sweet, ethereal odor, a greasy feeling when rubbed between the fingers, and a pungent taste. According to Versmann, 100 parts of water dissolve 360 parts of chloral hydrate. Prof. J. U. Lloyd, in *Supplement to American Dispensatory* (1880), writes: "When the therapeutical use of chloral hydrate was first agitated in this country, the writer was obliged to prepare the article in a limited way, until a supply could be obtained from abroad. Few persons can realize, without actual experiment, the care that is necessary, and the large amount of chlorine required for the production of even a limited quantity of this agent. It has been calculated that 1 pint of alcohol will require at least 316 gallons, or 73,233 cubic inches of chlorine, and there will be formed about 396 gallons or 91,542 cubic inches of hydrochloric acid gas."

Description and Tests.—CHLORAL (*U. S. P.*), *Chloral hydrate.* "A crystalline solid, composed of trichloraldehyde or chloral with 1 molecule of water. It should be kept in glass-stoppered bottles, in a cool and dark place. Separate, rhomboidal, colorless and transparent crystals, having an aromatic, penetrating, and slightly acrid odor, and a bitterish, caustic taste; slowly volatilized when exposed to the air. Freely soluble in water, alcohol, or ether, also in chloroform, benzol, benzin, carbon disulphide, fixed and volatile oils. It liquefies when triturated with about an equal quantity of camphor, menthol, thymol, or carbolic acid. When heated to about 58° C. (136.4° F.), it melts, forming a liquid having a specific gravity of about 1.575, which, at a higher temperature, should not evolve inflammable vapors. Liquefied chloral solidifies to a crystalline mass between 35° and 50° C. (95° and 122° F.). Chloral is decomposed by caustic alkalies, alkaline earths, and ammonia, chloroform being formed, and a formate of the base produced. A freshly prepared, aqueous solution of chloral is neutral, but gradually acquires an acid reaction. A neutral alcoholic solution remains neutral permanently. Chloral should be dry, and not readily attract moisture in dry air. A solution of chloral (1 in 20) in diluted alcohol, acidulated with nitric acid, should remain unaffected by silver nitrate T.S. (absence of hydrochloric acid and chlorides. If 1 Gm. of chloral be dissolved in 2 Cc. of warm water, mixed with potassium hydrate T.S. in slight excess (about 8 Cc.), the mixture filtered, and a portion of the clear filtrate treated with iodine T.S. until it is yellowish, no yellow, crystalline precipitate (iodoform) should appear within ½ an hour (absence of chloral alcoholate"—(*U. S. P.*).

Its alcoholic solution is neutral, and when the chloral is pure and recent, the aqueous solution is also, but with the chloral of commerce, the latter solution usually exhibits a slightly acid reaction. Chloral hydrate dissolves in glycerin, and this solution has the property of dissolving many alkaloids that are nearly or quite insoluble in that menstruum (glycerin). This property of dissolving alkaloids, insoluble in water, is also possessed by the aqueous solution of chloral hydrate, and both this and the solution of chloral hydrate in glycerin, was recommended for the purpose by Mr. Fairthorne. By placing together equal weights of camphor, and chloral hydrate, a clear liquid results, which is decomposed by water into the original substances. It is dissolved by alcohol, glycerin, chloroform, ether, and the fixed oils. This liquid was named CAMPHORATED CHLORAL, but is rarely used.

With aqueous solutions of the caustic alkalies, chloral hydrate is entirely resolved into alkaline formates and chloroform. Thus, with hydrate of sodium, the reaction will be as follows: $C_2Cl_3H_3O_2+NaOH=CHCl_3+NaCHO_2+H_2O$. It was this property, which chloral hydrate possesses, of producing chloroform when in contact with an alkali, that led Liebreich, in 1869, to reason that it might be used as a remedial agent. In 1873, it was found that chloral hydrate would prevent decomposition of albuminous substances, such as milk, meat, and animal matters generally (*Comptes Rendus*, Feb., 1874, and *Pharm. Jour. and Trans.*, 1876), and it is at present used in solution for injecting anatomical subjects. Chloral hydrate solution rendered slightly alkaline with carbonate of sodium, entirely prevents the coagulation of blood (Ore).

According to Meyer and Haffter, 165.5 grains of chloral hydrate consume 1000 Cc. of normal sodium solution. Theoretically, chloral hydrate should yield 72.2 per cent of chloroform, when agitated with slight excess of strong solution of caustic alkali; but, practically, the yield is generally between 70 and 72 per cent, often below 70 per cent with commercial chloral hydrate. Chloral hydrate should never present a pink appearance, and should dissolve in concentrated sulphuric, hydrochloric, or nitric acids, with formation of colorless solutions, and, with the *latter* acid, should not evolve red fumes. When pressed between two pieces of filtering or blotting paper, chloral hydrate should produce no stain.

When an aqueous solution of chloral hydrate is acidulated with diluted sulphuric acid, and the solution faintly tinged with a few drops of solution of permanganate of potassium, it should not decolorize in several hours. If the solution becomes quickly colorless, the chloral hydrate has partly decomposed.

For therapeutical purposes hydrate of chloral must be strictly pure, as impurities which occasion irritating and even serious effects are by no means rare. It must form a hard, white, or transparent crystalline mass, be completely soluble in water, not smell of chloride of carbon or hydrochloric acid, but retain the peculiar penetrating odor of chloral. It would be dangerous to employ hydrate of chloral contaminated by chlorous acetylene, chloride of carbon, and other incidental products, and hence great care must be observed in its preparation.

Action and Toxicology.—Prof. Liebreich first experimented with chloral upon frogs and rabbits, and then upon human subjects, using it internally, and by subcutaneous injections. M. Demarguay, who experimented with it, in a communication to the Academy of France, observed that it produces a well-marked soporific effect upon weak patients, the duration of which effect is in proportion to the debility of the patient; that the sleep induced by it is calm, being disturbed only in patients suffering from acute pains, and that it may be given in doses of from 1 to 5 grammes (15 to 77 grains). He states that the breath of the person smells of it. He does not believe with Prof. Liebreich that it is decomposed into chloroform and formate salt in the blood, but agrees that it is the most rapid of all the then known soporifics. In fact, there are several reasons why Liebreich's theory of the action of chloral, being due to the formation of chloroform, are untenable, though the point is still in dispute, and the majority of investigators seem to think that, while some chloroform may be formed, the whole of the action of chloral can not be attributed to that agent alone. Among these reasons are the following: After the administration of chloral, chloroform can not be detected in the blood, excretions, or exhalations; the effects of chloral are different from those of like amounts of chloroform; chloral is less anæsthetic, but greatly and positively more hypnotic than chloroform; and, lastly, chloral crystals have been detected in the blood, while the urine has yielded chloral decomposition products.

Dr. B. W. Richardson, of London, who has also experimented with this agent, sums up its effects as follows (*Med. Times and Gaz.*, Sept. 4, 1869): Hydrate of chloral can safely produce deep and prolonged narcotism; during a portion of the period of this narcotism, there may be complete anæsthesia with absence of reflex actions, and a condition in which every kind of operation fails to call forth consciousness. There are also intervals of apparent exalted sensibility, and during the narcotism there is invariably a reduction of temperature; in the transition from drowsiness to stupor there is no stage of muscular excitement, but in birds, vomiting. It produces muscular relaxation, which extends to the muscles of volition, to the iris, and to the muscular arterial system, and, from the condition of the muscles after death we may infer that this paralysis is in part due to change within the muscular structure itself; its action on the nervous system is primarily on the sympathetic ganglia, afterward on the cerebrum, and, lastly, on the heart; when recovery takes place it is followed by no bad results; in fatal cases the functions destroyed are (1) the cerebral; (2) the voluntary muscular; (3) the respiratory; (4) the heart; in small proportions it somewhat arrests the coagulation of the blood; in large quantities it stops the process of coagulation altogether, destroys the blood corpuscles and produces general destruction of blood, but the dose required to produce extreme narcotism need not be so large as to lead to serious derangement of the blood. Dr. Richardson believed the effects of chloral to be the result of the action of chloroform.

Dr. Wm. A. Hammond (*Med. Record, N. Y.*, 1870, p. 499), from some careful observations, in numerous experiments made by himself, believes he has clearly demonstrated (1) that pretty large doses of the chloral hydrate produce at first congestion of the brain, probably from vaso-motor paralysis accompanied by functional exaltation; (2) that this stage is soon followed by one of cerebral anemia (perhaps from cardiac and cerebro-spinal paralysis), with the resultant drowsiness deepening into profound sleep; (3) that small doses produce only the congestion and excitement, with no subsequent hypnotic effect. He is satisfied that it is a remedy of real value in many nervous diseases. M. Bouchut (*L' Union Médicale*, Nov. 13, 1869) considers hydrate of chloral a powerful sedative of the motor and sensory nervous system, the doses of which should not exceed 5 grammes (77 grains) for adults, and 2 grammes (31 grains for children). Its effects are more prompt when given by rectum than by mouth, and, when injected subcutaneously, it occasions formidable eschars. When the agent is pure, and in the state of solid hydrate its results (most calm hypnotism and almost absolute insensibility) are rapid, manifest, and energetic, its action lasting longer than when chloroform is employed.

Dr. Jules Worms, after a series of experiments, concludes that hydrate of chloral dissolved in 10 parts of water can be drank without any inconvenience to the amount of 10 grammes (154 grains); the effect is felt with 1½ or 2 grammes (23 or 31 grains), but there are some obstinate cases which require a dose of 2 or 3 grammes; in about 10 or 15 minutes after the digestion of the hydrate, a calm, often profound sleep, occurs without any modification in the temperature of the body, in the regularity of the pulse or the respiration, and which continues for 7 or 8 hours, and the awaking from which is not accompanied by headache, nausea, torpor, or other disagreeable sensations.

We should here observe that, unless the chloral hydrate is pure, it may not only fail in producing some of its beneficial effects, but it may likewise occasion serious symptoms; and it is by no means improbable that the unexpected deaths that have sometimes followed its internal administration in medium doses were due to the impurity of the chloral employed.

That chloral hydrate is a powerful agent for good or evil, accordingly as it is employed, is now well recognized. Briefly, we shall here give the action of the drug as now understood. Chloral is distinctly antiseptic, and animal structures may be preserved by it for a considerable time. Applied to the skin and kept in contact, it will cause redness and inflammation, and upon the mucous membranes it occasions pain. Under certain conditions it is vesicant. It is powerfully irritant to denuded surfaces and wounds. Taken internally, the taste is pungent and hot, and the salivary flow is greatly augmented. At first a cooling sensation is excited in the stomach, but this is followed by warmth, and if in moderate amount the appetite is stimulated without any ill after-effects. If the amount be large, however, gastric irritation, with nausea and vomiting, is apt to occur. Injected into the rectum it causes heat and irritation, and subcutaneously produces pain and sloughing. In ordinary or even large amounts, it is thought to have but little effect upon the blood. The clots found after death from chloral are now attributed to "stasis of the blood in the vessels from lack of propelling power in the heart and arteries" (Jeançon). Chloral fulfils three indications; it controls pain though less effectually than opiates, it subdues spasm, and it induces sleep. The effects are quite uniform, though occasionally an individual will be found in whom the ordinary hypnotic doses fail to cause sleep, and such persons are then likely to have headache and become delirious under its action. A very short stage of excitement precedes its secondary action when a hypnotic dose (15 to 30 grains) is administered, but this is followed by a calm, refreshing slumber, remarkably like natural sleep, without dreams, and the patient awakens in about 3 to 6 hours without experiencing any of the unpleasant after effects, either of the head, stomach, or bowels, so common to opium and some of the other narcotics. While large doses of chloral produce deep narcotism, such an effect as is produced by the hypnotic dose can not be called distinctly narcotic, for the patient may be aroused to take nourishment, or even to respond to Nature's calls, and fall to sleep again as if nothing had disturbed his slumbers. Occasionally an individual may be found who, though asleep under its use, will be disturbed by hallucinations and dreams, and when awakened will suffer from nervous and gastric symptoms. Chloral is not a true anodyne in the sense that the morphine salts are, and allays the sensibility to pain only when given in very large doses—amounts sufficient to produce abolition of the cerebral functions. During sleep under chloral the face is somewhat flushed, and the pupils slightly contracted, becoming normal upon waking; the pulse may be unaffected or very little slowed, while the respiration is wholly undisturbed. The sleep of chloral is produced by the cerebral anemia caused by the drug. Large, dangerous doses of chloral induce a profound narcotism with muscular relaxation, reduced temperature, and loss of sensation and reflexes. Death from lethal doses is preceded by all the symptoms of syncope. The breathing becomes slow and shallow, the pulse is weak, rapid, thready, and fluttering; a sinking sensation is experienced; complete muscular relaxation ensues, and both sensibility and reflexes are abolished; the pupils first contract, then dilate; the extremities are cold and paralyzed, the surface pallid, and the countenance partially livid. Death is preceded first by the suspension of the cerebral functions, which is followed by respiratory paralysis, and lastly, by paralysis of the motor ganglia of the heart, though some cases result directly from sudden cardiac paralysis, especially where fatty degeneration of that organ exists. The heart is arrested in diastole in acute chloral poisoning, and the patient dies anæsthetized and paralytic. Prof. J. A. Jeançon (Scudder's *Materia Medica*), thus states the action of chloral: "Chloral hydrate acts primarily and directly upon the gray substance of the medulla oblongata, some gray substance of the cortex, and upon the posterior tubercular quadrigemina. The respiratory centers are primarily affected, and from them a reflex action is exerted upon depressory fibres of the pneumogastric of the heart, causing a reduced pressure of the blood in the arterial system, when moderate doses are taken. In large doses the psycho-motor and motor fibres of the gray mass of the cortex of the middle cerebral lobe are there included in its action, which is then intensified, the circulation and respiration much affected, and complete muscular relaxation produced. The center of common sensation is temporarily paralyzed. The sensation of the skin and the vegetative functions of the body are but imperceptibly disturbed."

While the blood is ordinarily but little affected by chloral hydrate, there are cases in which a blood lesion is produced by the drug, death being preceded by a scorbutic state with eruptions, purpuric spots, enlarged and ulcerated gums, prostration, and collapse. Chloral has produced an erythematous eruption, followed by desquamation, a rash most likely, it is said, to be produced in children, and in the debilitated and cachectic, particularly those suffering from nervous disorders. It is most liable to occur when alcohol and chloral are taken at the same time.

Chloral hydrate is taken by some individuals until the chloral habit is formed. *Chronic chloralism* presents serious disturbances, the chief among which are the following: The chloral habitué is a voluble talker, speaking in a quick and excitable manner; the eyes are irritable and hyperemic, though brilliant. Tinnitus, sudden dizziness, wakefulness with irritability and great nervous unrest, are experienced, and the victim can not sleep without the hypnotic effects of the drug. Mental hebetude, melancholia, loss of memory, hallucinations, and maniacal excitement, are among the nervous symptoms. The person is easily tired and has no capacity for exertion; efforts at work are prostrating, and all the voluntary movements are irregular and uncertain. There may be no appetite, or if present it is always capricious, digestion is very feeble and attended with dyspnœa when the stomach is full, and the stools light and pasty, showing a lack of bile, though the latter stains the urine, which may also contain albumen. The heart-action becomes progressively feeble and irregular, and rashes and purpuric spots may appear on the skin.

Death from chloral reveals, upon post-mortem examination, meningeal, cerebral, spinal, and pulmonary congestion, with a distended right heart.

The treatment of *acute chloral poisoning* is similar to that for narcotics. As a peculiar coldness pervades the victim, artificial heat should be applied to the extremities, and to the præcordium. Alcohol in repeated small doses may be given by the mouth, rectum, or subcutaneously. Friction, flagellation, faradization, or galvanism to the diaphragm, cold applications to the head and neck, artificial respiration, and coffee or caffeine to sustain the heart, should be administered. Atropine, digitalis, and amyl nitrite may be used for the same purpose. Strychnine, hypodermatically, for its effects upon the spinal cord should be given in $\frac{1}{60}$-grain doses about every half hour. *Chronic chloralism* is best treated by gradually lessening the quantity of the drug consumed; nourishing and easily digested food, and tonics, particularly the chalybeates, should be exhibited. Cathartics should be occasionally resorted to. Cannabis indica is said to aid the stomach, and lessen the appetite for chloral. As calmatives to the nervous system, lupulin and hyoscyamus may be used, while strychnine is indicated as a nerve stimulant. That strychnine was an antidote to chloral was announced by Liebreich (*Comptes Rendus*, Feb., 1870), basing his conclusions upon experiments performed upon rabbits.

Medical Uses and Dosage.—Chloral is one of the most important remedies in the materia medica. With but few remedies is it so absolutely essential to know the proper indications for its use, for if used when contraindicated, it takes but very little of chloral to kill. It is contraindicated always when there is an anemic condition of the brain. It can not safely be given to old topers, nor should it be used where the heart-walls are thin or where fatty degeneration of the organ is established. All cases of marked depression are warnings not to give chloral. On the other hand, when indicated, no remedy is more useful nor more satisfactory in its results. An *active hyperemic state of the brain* is an indication for chloral, and particularly if there be *sleeplessness* from nervous excitement. Its use here is the same as that of potassium bromide, which it exceeds in efficiency. If sleeplessness be due to pain, it is less efficient than opium. As before stated, three important indications are fulfilled by chloral. It produces sleep, relaxes spasm, and to a certain extent relieves pain. In all cases of *sleeplessness*, and more especially when this condition is the result of brain exhaustion, from previous mental or moral excitement, or in sleeplessness and excitement where opium or other narcotics are objectionable, as in *acute mania*, *delirium tremens*, *hysteria* of plethoric females, etc., chloral is indicated, but it should be remembered that it is not to be administered to persons greatly enfeebled, nor to those who are subjects of any dyspnœic or cardiac affections.

While chloral is a dangerous remedy in the depression of confirmed inebriates, it is of value in *delirium tremens*, where opium would be inadmissible. The condition admitting it is one of over-stimulation of the brain and nerve centers, while in the opposite condition, where the brain suffers from a want of stimulation, it is inadmissible, while opium and alcohol act beneficially. Use chloral where there is great excitement, dry skin and tongue, increased temperature, and flushed face. The pale face, feeble circulation, muscular relaxation, and surface bathed in perspiration, are contraindications to its employment. In properly selected cases chloral hydrate may be used to relieve pain in *neuralgia*, *cancer*, *rheumatism*, *toothache*, *lead colic*, pain from the pressure of *tumors*, etc., on nerve trunks, *painful disease of joints*, and in painful *minor surgical operations;* in some instances, however, the pain seems to be intensified after the transient and anodyne effects have passed off; to reduce the animal heat in *fevers*, and especially those following *surgical operations* when the temperature is increased and the patient is excited or delirious; to produce extreme muscular relaxation in medical and surgical cases, where it is required to overcome resistance or *spasm;* in *tetanus;* passage of *biliary calculi*, it likewise dissolves these calculi; *vesical* and *renal calculi; strangulated hernia; reduction of dislocations* or *fractures*, etc. It has also been successfully used in severe *sea sickness*, *vomiting of pregnancy* (enema), *vesical catarrh*, *metritis*, *consumptive cough*, *puerperal peritonitis*, *phlegmasia dolens*, *gastralgia*, *enteralgia*, *nervous asthma*, *laryngospasmus*, etc. According to Dr. A. Jacobi, its use is contraindicated in gastric ulcerations, as the remedy is slightly caustic, and in catarrhal or ulcerative affections of the larynx, in which cases it produces pain and cough. It is a prompt remedy for *hiccough*. For *idiopathic tetanus* it is one of the best known remedies. It should be used when the temperature is high, giving 30 grains at bedtime, repeated if necessary at midnight. Sustaining food, as eggs and beef tea, should be administered freely. While this does not lessen the severity of the spasms, they become much less frequent. Like all other treatment, it will often fail. As the chief danger from *strychnine poisoning* lies in the convulsions produced, the antispasmodic power of chloral renders it valuable as an antidote to that poison, though large doses are required, and if great care is not exercised lethal effects may be produced by the large doses of the antidote employed.

During *parturition*, chloral hydrate, in doses of from 15 to 30 grains, repeated every half hour or hour, and continued no longer than is necessary to effect the desired result, is stated to have been useful in regulating uterine contractions, and lessening their severity, in favoring dilatation of the os, and in soothing undue nervous and mental excitability. It is an efficient remedy for *after-pains*. By those who have employed it in *eclampsia*, it is considered one of the best agents for overcoming the convulsions, although instances of failure have occasionally occurred; in this malady it is administered in doses of 10 or 15 grains, repeated as required, every 10, 15, or 20 minutes; and in severe cases, from 30 to 60 grains in solution may be employed as a rectal enema. In *epilepsy*, *chorea*, *pertussis*, and *paralysis agitans*, although not effecting recovery, it greatly lessens the severity of the paroxysms, as well as of muscular movements. One part of chloral hydrate dissolved in 6 parts of distilled water, and administered in fluid drachm doses every half hour, has frequently proved advantageous in *hemicrania*, as well as in *retention of urine;* in these cases, after sensations of relief have been experienced, the intervals between the doses should be extended to every 2 hours, for the last three or four periods of administration. Occasionally the headache is said to be more severe after the effects of the chloral have subsided. Probably the cases were not well selected. Alone or combined with specific hyoscyamus it has relieved the wretched *headaches of the menopause*. Ten grains of the drug in solution with 10 drops of henbane, are given every hour until sleep is induced.

Prof. R. L. Thomas uses chloral extensively in the *gastro-intestinal diseases of children*, with nausea and uncontrollable vomiting, when the condition depends on cerebral hyperemia. Small doses are employed, from 1 to 4 grains to 2 ounces of water or syrup, and a teaspoonful of the mixture administered every half hour or hour, as indicated. This use of chloral in this manner, is, so far as we are aware, original with Dr. Thomas. Prof. Scudder recommended 1-grain doses of chloral with hydrastine (berberine), in *irritable dyspepsia*. A rather novel use of chloral is reported in Webster's *Dynamical Therapeutics*, in which a physician claims to have cured two cases of *albuminuria* by rectal injections of chloral. One was a much debilitated woman whose condition developed after confinement; the other an Irishman "in extremis" from what appeared to be all the symptoms of "Bright's disease." The urine was scanty and albuminous, and chloral dissipated the urgent symptoms, while the augmented flow of urine was maintained by nux vomica and digitalis alternately administered.

As a local application, chloral hydrate has proved serviceable in several affections. Equal parts of chloral and distilled spirit of horseradish root, applied upon the affected parts by means of a soft sponge probang, every day, or every other day, has proved efficient in the *ulitis* of pregnant women; before applying it, the mouth should be cleansed, and any excess of tartar on the teeth be removed. It produces a slight degree of pain, and leaves a superficial, whitish eschar, which disappears after some hours. Finely powdered chloral hydrate sprinkled upon the surface of a Burgundy pitch plaster, and this applied over painful parts, has been found effectual in *lumbago*, *sciatica*, *pleurodynia*, and *intercostal neuralgia*. The plaster must be allowed to remain upon the part for 1 or 2 days, or until the skin beneath becomes covered with small vesicles filled with a limpid serosity; the plaster is then removed, each vesicle opened with a needle, and the whole covered with simple cerate spread upon a soft cloth. They become speedily healed. In *scald-head*, *baldness*, *dandruff (pityriasis)*, and especially in obstinate, indolent *ulcers*, the local application, daily, of a solution of chloral hydrate, 10 or 20 grains in distilled water, 1 fluid ounce, will be found highly efficient; some smarting may follow each application. A weaker solution (1 in 100) will be advantageous as a palliative and antiseptic in *ulcerated cancer of the breast*, *cancer of the uterus*, in *suppurating cavities*, *diphtheritic* and *gangrenous surfaces*, also to remove the offensive odor in *ozæna* (1 in 300), as well as that which emanates from the axillæ and feet (1 in 150) of certain persons. It may be applied on lint, or be used as a wash, by injection or by spray. A solution of chloral hydrate (30 grains to 1 ounce of water) will often prove serviceable as a local application to painful *bunions* and *chilblains*. One part of chloral and 16 parts of Carron oil (equal parts of lime water and linseed oil), form a mixture that has acted promptly and efficiently in *burns* and *scalds*. Camphorated chloral is an efficient topical application to painful parts.

Prof. Locke regards it a valuable antiseptic in *diphtheria*. He recommends a solution of from 20 to 25 grains of the salt in 1 ounce of glycerin, the solution to be painted upon the false membrane, the removal of which it promotes, as well as overcoming the disagreeable stench. *Itching* of the mucous surfaces is relieved by a weak solution of chloral (2 to 5 grains to 1 ounce of water).

Chloral is efficient as an injection (1 to 2 per cent) in *gonorrhœa*. A weak solution (7 grains) in brandy and water (1 ounce), is reputed an efficient lotion in the *night-sweats of consumption*, while a solution of 1 part in 100 of water is reputed a good surgical application in *indolent*, *gangrenous*, or *cancerous ulcers*, etc. *Erectile tumors* and *varicocele* have been cured by an injection of a 10 per cent solution, though this method is by no means free from danger.

Chloral has a limited use in *ear affections*. It may be used to destroy *granulations of the tympanic cavity*, when there is an excessive purulent discharge. A 5 per cent solution is preferred. It may also be employed to destroy the base of the pedicle after the removal of *polypi*. Locally applied, chloral-camphor will mitigate the pain of *mastoid disease*, while the hydrate, given internally in doses of from 2 to 5 grains, every 2 hours, will sometimes allay the pain from *acute catarrh of the middle ear*.

Chloral hydrate is not used in subcutaneous injection (except in *strychnine poisoning*), as its action is too irritating and apt to be followed by troublesome abscesses, and should it be injected into the veins, its influence upon the heart and lungs is of a dangerous nature. Internally, for an adult, its ordinary dose varies from 10 to 30 grains, to be repeated every 1, 2, or 3 hours, as indicated; children, who stand chloral better than adults, also require much less, say, as many grains for a dose as there are years of the child's age. The dose, however, may vary from 5 to 10 grains as a hypnotic, which, in severe cases, may be increased to 20 or 30 grains. Liebreich recommends 7 grains as the dose for children; for adults from 25 to 30 grains, where short intervals of sleep are required, and repeated every 2 or 3 hours, and in cases where more determinative effects are demanded at once, from 60 to 120 grains at once. As a rule it is better to prescribe moderate and frequently-repeated doses rather than one large dose. The best mode of its administration is in distilled water, being well diluted, 1 part of the hydrate to 50 of water. When the dose is large, its bitter, pungent taste may be corrected by the addition of some syrup, tincture of orange, or by giving it in mucilage. There is some evidence of cumulative effects having been produced by chloral. In painful states, morphine, when not otherwise contraindicated, is often administered in conjunction with chloral hydrate. Alkaline additions to it must be avoided, and the chemical constituents of the food taken before or after its administration should be taken into consideration. It may be given in some aromatized syrup, to conceal its taste. When used in enema, the saturated solution should be mixed with some mucilaginous, albuminous, or oleaginous fluid. Chloral hydrate has been incorporated in suppositories, and Trelat proposed a mixture of morphine and chloral for producing incomplete anæsthesia for *minor operations*.

Specific Indications and Uses.—Sleeplessness, from cerebral hyperemia; pain, with cerebral hyperemia; pulse soft and temperature normal or somewhat increased; delirium tremens, with great cerebral excitation, dry, hot skin, dry tongue, elevated temperature, and flushed face; surgical fever, with elevated temperature, patient excited and delirious; spasms, when not associated with debility or depression; irritable dyspepsia (1 grain with berberine); nausea, retching, and vomiting, when dependent upon cerebral hyperemia; strychnine poisoning. Contraindicated by debility, depression, and organic heart and lung affections.

Related Drugs and Derivatives. CHLORAL ALCOHOLATE. When chloral is mixed with one equivalent of alcohol, white crystals of chloral alcoholate are formed, resembling in appearance hydrate of chloral. They differ, however, in therapeutical action, and in being freely soluble in cold chloroform, carbon disulphide, and turpentine, while less soluble in cold water than the hydrate. When warmed with sulphuric acid, a reddish-brown, or brown solution is formed, and with nitric acid, red vapors are evolved (Hoffman). Chloral alcoholate yields 59.8 per cent of chloroform. It is not used in medicine, unless as an adulterant of chloral hydrate, and is of interest simply from the relation it bears to this substance.

CHLORAL-AMMONIUM ($CCl_3.CH.OH.NH_2$), *Trichloramidoethylic alcohol*, occurs in small, white needle crystals, soluble in water, in which solution it is liable to undergo decomposition. Alcohol also dissolves it. It is prepared by rapidly passing into a chloroform solution of anhydrous chloral a stream of dry ammonia gas. A crystalline product is deposited, from which the chloroform is decanted; the crystals placed between layers of bibulous paper, and pressed, are finally dried in *vacuo*. It is employed as a hypnotic and analgesic, being indicated in cases due to *nervous* and *painful disorders*, accompanied by *nervous insomnia*. The dose is from 15 to 30 grains.

CHLORAL CYANHYDRIN, *Chloral hydrocyanate*, *Chloral hydrocyanin*, *Chloral cyanhydrate* ($CCl_3.CHOHCN$).—This substance is prepared by the interaction of chloral hydrate and anhydrous hydrocyanic acid at a high temperature. It may also be prepared from a solution of the acid. This salt forms white, rhombic, plate-like crystals, easily dissolving in water, ether, and alcohol. It fuses at 61° C. (141.8° F.), has the combined odor of its ingredients, and, when heated to between 215° and 220° C. (419° and 428° F.), boils, and at the same time more or less decomposition ensues. Alkalies decompose it, the result being hydrocyanic acid, formic acid, and chloroform. It keeps well in aqueous solution, and yields 15.5 per cent of hydrocyanic acid; 1.29 parts in 9 parts of distilled water has the strength (2 per cent) of the official hydrocyanic acid. This compound is recommended as a substitute for prussic acid.

HYPNAL, *Monochlorantipyrine*, or *Tri-chloraldehyd-phenyl-dimethylpyrazolon*.—This hypnotic is produced by the interaction of chloral hydrate and antipyrine. It occurs as transparent, odorless, tasteless, rhombic crystals, soluble in water. It fuses at 58° to 60° C. (136° to 140° F.). This drug is hypnotic, antispasmodic, and analgesic, and is employed in *painful conditions* to produce sleep as well as to give rest where sleep is disturbed by harassing *cough*. Its value as a remedial agent is still in dispute, some claiming it to be a safe remedy in every respect, while others declare it liable to produce serious depressant effects, while others regard it as possessing but feeble hypnotic powers. It was introduced, in 1885, by Dujardin-Beaumetz as a soporific. The dose ranges from 15 to 30 grains, in capsules.

CHLORALOSE.—This crystalline body is one of the newer additions to medicine and is prepared by the reaction of anhydrous chloral and glucose (dry) upon each other when equal quantities are heated together for 1 hour at the temperature of boiling water. When cool, the resulting mass is first treated with a small amount of water and then with boiling ether. The portions soluble in ether are separated from excess of chloral by several distillations with water, then the chloralose is allowed to crystallize. Hot water and alcohol dissolve it. It is almost insoluble in cold water, and has a bitter taste. Hauriot and C. Richet regard this agent as a better hypnotic than chloral, it having given good results as a producer of refreshing sleep after both chloral and morphine failed. Physiologically, it is said to excite the medulla, and to exert its hypnotic action on the brain proper. Chloralose has been used in *hysteria*, *chorea*, and *epilepsy*. Doses as large as 35 grains were administered by Dr. Féré (1893). The sleep so produced in some of the hysterical patients was stertorous, and urine was passed involuntarily while asleep, thus exhibiting its pronounced effect in suspending cerebral action. Others report very favorably concerning its action, though occasional cases occur where headache, faintness, nausea, vertigo, and cardiac irregularity resulted from comparatively small doses. It has cured *dyspepsia* in a neurasthenic subject, and has been given with success in *valvular heart disease* of chronic character, and in *neurasthenia*. In *paralysis agitans*, 10 grains produced a deep sleep, followed, however, by aggravation of the muscular tremor (Ségard). It has neither a constipating nor irritating action on the digestive tract. The dose is from 3 to 10 grains, given preferably in capsule.

URALIUM, *Chloral-urethane*, *Ural* ($C_5H_8Cl_3O_3N$, or $CCl_3CH.OH.NHCO_2C_2H_5$).—If urethane be dissolved in fused chloral hydrate and strong hydrochloric acid added, an insoluble (in water) mass results in the course of a day. If strong sulphuric acid be now added to this mass and the whole washed in water, an oily fluid, which afterward crystallizes, is produced. This is uralium, and it has a melting point at 103° C. (217.4° F.). It refuses to dissolve in cold water, while boiling water decomposes it. Alcohol freely dissolves it, as does also ether, and from these solutions it may be precipitated again by water. This body is said to be superior to chloral in hypnotic action, and is administered in doses of about 15 to 40 grains. It probably possesses no advantage over other hypnotics, and its lack of solubility will militate against its general utility.

SOMNAL.—*Ethylated chloral-urethane* ($C_7H_{12}Cl_3O_3N$). This compound is the result of a combination of chloral, urethane, and alcohol. As employed, it is a clear liquid, colorless, and has a pungent, burning taste, recalling that of spirit of nitrous ether. The dose ranges from 15 to 30 drops in liquorice water, or in solution, in water, flavored with raspberry or other syrups. It is hypnotic, though regarded as feeble in its action, and dangerously depressant to the heart's action. Others claim that a rather prolonged sleep (6 to 8 hours) is induced, and is followed by no evil after-effects.

CHLORALAMIDE.—*Chloralum formamidatum*, *Chloral formamide*, *Chloral formamidum* ($CCl_3CH.OH.CONH_2$). This hypnotic results from the interaction of formamide and anhydrous chloral, and is official in the *German Pharmacopœia*. It forms lustrous, white, slightly bitter crystals, devoid of odor. It is soluble in alcohol (1½ parts), and slowly so in cold water (20 parts). Diluted acids do not affect it, but alkalies and water above 60° C. (140° F.) decompose it, forming ammonium formate and chloral hydrate. It should, on heating, volatilize without giving off inflammable fumes, and a 10 per cent solution in alcohol should not color litmus paper red, nor be immediately affected by solution of silver nitrate. It fuses at 115° C. (239° F.). It should not be confused with the chloral-derivative known as *chloralimide* (CCl_3CHNH), which occurs in long, odorless, tasteless, and colorless, acicular crystals, and is produced by heating chloral-ammonium. The latter is a stable salt, dissolves in alcohol, chloroform, ether, and fixed oil, but is insoluble in water. It fuses at 166° C. (330.8° F.). It is seldom employed in medicine. Chloralamide is hypnotic, and has been successfully employed as such in the treatment of the *insane*, in cases where great excitement is absent. If this condition is present it fails to operate as well. The same is true of its action in *delirium tremens*. In *painful conditions*, where the pain is not too severe, it induces refreshing sleep. It has been employed for this purpose in *asthma*, *chorea*, *cardiac affections*, *spinal affections*, *rheumatism* (muscular), and *insomnia*, of old or young subjects. It is thought to have a better action in *insomnia* due to *heart troubles* than chloral and other hypnotics. Mucous tissues are not irritated by it, nor is digestion deranged. It acts quickly, in from 15 to 50 minutes, giving a prolonged sleep, not followed by unpleasant after-sensations. Chloralamide may be given in wine, or in diluted whiskey, or better still, in warm (not hot) water. The dose is from 20 to 40 grains.

Chloral-phenol.—*Carbolated chloral*, *Chloral-carbol*. Equal parts of carbolic acid and hydrate of chloral triturated together, produce this substance, which is a viscid, colorless liquid, volatilizing with an odor closely resembling that of chloral hydrate. To the taste it is sweet and caustic. It may be mixed with alcohol, chloroform, ether, carbon disulphide, and acetic acid. Albumen is coagulated by it in small amounts, but larger quantities redissolve it. At 20° C. (68° F.), its density is 1.289. It is a local irritant, and a topical anæsthetic. *Toothache* is said to be relieved when cotton saturated with it is placed in the dental cavity. The cotton from the cotton-wood tree (*Populus canadensis*, Michaux), impregnated with it is preferred by Garrison (1881). The cotton so treated is known as *chloro-carbolated cotton*.

Chloral-menthol.—*Mentholated chloral*. When equal amounts of menthol and chloral are rubbed together and heated carefully by means of a water-bath, a colorless, oily liquid having the odor of peppermint and warm to the taste, results. It dissolves with freedom in alcohol, benzin, and chloroform, and is employed for its local anæsthetic and counter-irritant action, cases of facial, as well as other *neuralgias* having been relieved by it. It has a density of 1.1984.

Chloral Camphoratum (N. F.).—*Camphorated chloral*, *Chloral et camphora*, *Chloral and camphor*. *Formulary number*, 23: "Chloral, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; camphor, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]. Mix them by agitation in a bottle, or by trituration in a warm mortar, until they are liquefied and combined"—(*Nat. Form.*). This preparation is employed as a counter-irritant and topical anæsthetic, particularly in *neuralgias*.

Chloral Carbamide.—Mix in a porcelain mortar urea (carbamide) 60 parts, and trichoraldehyde hydrate 165.5 parts. A liquid will result which should then be dissolved in three times its bulk of water at 60° C. Upon cooling the solution a crystalline mass of chloral carbamide is deposited. This body, which Kobert has shown to act like chloral, but much slower, is easily soluble in cold, but less easily in warm alcohol. Warm water readily effects its solution.

Chloraloximes.—A series of compounds recently introduced, which are not readily dissolved by water, but are soluble in ether and alcohol. Hot water has a tendency to decompose them, chloral hydrate being reformed. In the system they are said to split up into chloral hydrate and their particular oximes. The names and fusing points of some of these chloraloximes are as follows: *Chloral benzaldoxime*, 62° C. (143.6° F.); *chloralacetoxime*, 64° C. (147.2° F.); *chloralacetaldoxime*, 74° C. (165.2° F.); *chloralcenophoroxime*, 98° C. (204.8° F.); *chloral-nitroso-beta naphtol*, 100° C. (212° F.).

CHLORAL BUTYLICUM.—BUTYL-CHLORAL HYDRATE.

Formula: $C_4H_5Cl_3O.H_2O$. Molecular Weight: 192.91.

Synonyms: *Butyl-chloral hydras* (*Br.*), *Hydrate of butyl-chloral*, erroneously called *Croton-chloral hydrate*.

Preparation and History.—This body is produced by the action of chlorine gas upon acetic aldehyde in the cold, and subjecting the resulting product to fractional distillation. The fraction boiling between the constant limits 163° and 165° C. (325.4° and 329° F.), contains the practically pure butylchloral. By dissolving this in water the hydrate is produced, and may be obtained by crystallization. This body was accidentally discovered by Krämer and Pinner, in 1870, while examining the by-products of Schering's chloral works. At that time they regarded it as *croton-chloral* ($C_4H_3Cl_3O$), an unsaturated compound, but in 1875 they found it to be *trichlorbutyl-aldehyde*, having the graphic formula: $CH_3.CHCl.CCl_2.CHO$.

Description.—The hydrate occurs in scaly crystals, fusing at 77.8° C. (172° F.), the resulting transparent fluid congealing at 71.1° C. (160° F.). It is soluble in hot water, alcohol, ether, and glycerin, more sparingly soluble in cold water (1 in 50), and practically not at all soluble in chloroform. Its taste is warm and bitterish. It vaporizes with the steam of water at 100° C (212° F.). Its aqueous solution should be neutral or but faintly acid to test paper. Decomposition gradually ensues in its solution, and in such a state it can not long be kept. Caustic alkalies (soda, potash, etc.), convert it into formate and chloride of the base employed, and bichlorallylene ($C_3H_2Cl_2$), but chloroform is not produced under such treatment, a fact to be anticipated from the graphic formula above given.

Action, Medical Uses, and Dosage.—This agent was introduced in 1870, by Liebreich, as a remedy for *trigeminal neuralgia*. Within a few minutes after the ingestion of from 10 to 30 grains of this salt, a heaviness and mental confusion, and dulling of the senses take place. Sensibility of the skin, first of the face, and then of the limbs, is impaired, and motion is more or less impeded, muscular tone being peculiarly conserved, so that persons impressed with it will remain in deep sleep sitting upright in their chairs. Within a half-hour after taking the above doses a deep and peaceful slumber supervenes without affecting the circulation, temperature, or respiration. Slight head symptoms, quickly passing off, are experienced on waking. Large doses may induce emeto-catharsis. Rather than narcotic, this agent is an anæsthetic, and is peculiarly effective in *neuralgia of the fifth nerve* and in *tic-douloureux*, and is not of much value in other neuralgic complaints. Anemic girls and women are most benefited by it. It is only palliative, and for this purpose is likewise beneficial in *dysmenorrhœa* and in *nervous headache*, provided there is no depression of the heart, no gastro-intestinal irritation, nor a hyperemic state of the brain, which are contraindications to its use. It has been used in *insomnia*, particularly of *phthisis* and *heart affections*, when chloral was inadmissible, or when the required dose of the latter was too large. It affects females more readily than males, and the ordinary dose for neuralgic affections is from 3 to 15 grains. Larger doses are not safe. It may be administered in syrup of licorice, glycerin, or syrup of peppermint. It is best given in successive small doses until anæsthesia is produced, stopping short of its hypnotic action. For its hypnotic effects it is given at bedtime, in doses ranging from 15 to 45 grains. The patient's condition, however, must be taken into consideration for much harm may come from such doses. Electricity, artificial respiration, and stimulants, applied to the extremities, are the means resorted to when over-doses have been swallowed.

CHLOROFORMUM (U. S. P.)—CHLOROFORM.

FORMULA: $CHCl_3$. MOLECULAR WEIGHT: 119.08.

SYNONYM: *Chloroformum purificatum* (*Pharm.*, 1880).

"A liquid consisting of 99 to 99.4 per cent, by weight, of absolute chloroform, and 1 to 0.6 per cent of alcohol. It should be kept in dark, amber-colored, glass-stoppered bottles, in a cool and dark place"—(*U. S. P.*).

History and Preparation.—The first discovery of chloroform was in 1831, by Mr. Samuel Guthrie, a chemist residing in Sackett's Harbor, N. Y.; subsequently, in 1832, Soubeiran, of France, and Liebig, of Germany, prepared it; neither of these gentlemen being aware of the other's discovery. Chloroform is yielded by a variety of processes. It is formed by the action of chlorinated lime upon alcohol, acetone, wood alcohol, and other organic substances. It is also produced by the action of chlorine upon marsh gas (methane, CH_4), and on methyl chloride (see *Amer. Jour. Pharm.*, 1881, p. 188); by the decomposition of sodium trichloracetate ($CCl_3.COONa$) with caustic soda, whereby sodium carbonate is formed as a by-product; and by the action of caustic soda upon chloral or chloral hydrate, sodium formate then resulting as a by-product (see *Chloral*). Until about 1882, the bulk of the chloroform of commerce was prepared by the action of chlorinated lime upon alcohol, whereby chloral is most likely formed as an intermediary product. In 1882, however, great improvements in the manufacture of acetone by the dry distillation of acetate of lime (see *Acidum Aceticum*) resulting in the cheapening of that article, made it possible to utilize Liebig's old reaction, according to which chloroform is made by distillation of acetone with chlorinated lime. The bulk of chloroform of the market is now obtained in this manner.

The yield of chloroform from acetone is considerable—namely, as high as twice the weight of the acetone employed. For an interesting paper on this subject see Prof. S. P. Sadtler in *Amer. Jour. Pharm.*, 1889, p. 321, wherein is also given the following equation as most likely expressing the reaction involved, calcium acetate being among the by-products formed: $2C_3H_6O + 6CaOCl_2 = 2CHCl_3 + Ca(C_2H_3O_2)_2 + 2Ca(OH)_2 + 3CaCl_2$. In addition to the advantage of a higher yield, greater purity is also claimed for the chloroform obtained by this process. As pure chloroform is now largely manufactured in this country, no formula for its preparation is given in the *U. S. P.* For detailed directions according to the old process with alcohol, see the *British Pharmacopœia*, 1885.

As the chloroform of commerce is often produced more or less impure, the *U. S. P.* has given the following process for its purification: *Purification.*—"Chloroform which fails to respond to these tests (*U. S. P.* tests) should be purified by the following process: Chloroform, four hundred grammes (400 Gm.) [14 ozs. av., 48 grs.]; sulphuric acid, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; dried sodium carbonate, twenty grammes (20 Gm.) [309 grs.]; deodorized alcohol, four cubic centimeters (4 Cc.) [65 ♏︎]. Add the sulphuric acid to the chloroform, contained in a glass-stoppered bottle, and shake them together occasionally during 24 hours, avoiding exposure to bright daylight. Separate the lighter chloroform layer, add to it the dried sodium carbonate, previously rendered anhydrous by heating it in a porcelain capsule on a sand-bath until it ceases to give off aqueous vapor, and shake them together frequently and thoroughly during half an hour. Then transfer the chloroform to a dry retort, add to it the alcohol, and distill, by means of a water-bath, at a temperature not exceeding 67.2° C. (153° F.), into a well-cooled, tared receiver, until the distillate measures two hundred and fifty-five cubic centimeters (255 Cc.) [8 fl℥, 299 ♏︎.]"—(*U. S. P.*).

Recently a physical method of obtaining pure chloroform was proposed by Pictet. It consists in subjecting chloroform to refrigeration to —82° C. (—147.6° F.), when pure chloroform solidifies, and may afterwards be distilled at a reduced temperature and pressure. An interesting chemical method has also been proposed by Anschütz (see *Amer. Jour. Pharm.*, 1893), by which chloroform enters into a solid combination. It consists in the formation of salicylide-chloroform, by allowing salicylide (C_6H_4COO, an anhydride of salicylic acid), or ortho-homo-salicylide ($CH_3C_6H_3COO$) and chloroform to remain in contact for 24 hours, when a crystalline, almost insoluble, product results, containing about 33 per cent of chloroform. This compound may be kept unchanged for a long time in closed containers. Salicylide-chloroform easily decomposes when heat is applied, yielding chloroform, free from the ordinary impurities, as these do not form crystallizable bodies with the above-named substances. Repeated use may be made of the same salicylide and ortho-homo-salicylide for the purification of chloroform according to this process.

Description.—The *U. S. P.* demands chloroform to answer the following description: "A heavy, clear, colorless, mobile and diffusible liquid, of a characteristic, ethereal odor, and a burning, sweet taste. Specific gravity: not below 1.490 at 15° C. (59° F.), or 1.473 at 25° C. (77° F.). Soluble in about 200 times its volume of cold water, and, in all proportions, in alcohol, ether, benzol, benzin, and the fixed and volatile oils. Chloroform is volatile even at a low temperature, and boils at 60° to 61° C. (140° to 141.8° F.). It is not inflammable, but its heated vapor burns with a green flame"—(*U. S. P.*).

Chloroform, when absolutely pure, has a density of 1.499 (Hirsch), or 1.502 (Schacht and Biltz), at 15° C. (59° F.). In this state it is exceedingly liable to decomposition upon exposure to diffused daylight and in contact with the atmospheric oxygen. The addition of a small quantity of alcohol has been found necessary in order to preserve it. Schacht and Biltz (see *Amer. Jour. Pharm.*, 1893) have determined the following specific gravities for chloroform, containing varying small amounts of alcohol. Specific gravity at 15° C. (59° F.):

Pure chloroform	1.5020
" " with 0.25 per cent alcohol	1.4977
" " " 0.5 " "	1.4939
" " " 1.0 " "	1.4854
" " " 2.0 " "	1.4705

The same investigators have found that, as a general rule, 0.25 per cent alcohol will prevent recognizable decomposition for one month or longer; 0.5 per cent will preserve the chloroform for nearly one year; and 1 per cent for several years. Similar results have been arrived at by Squibb (1893). According to the investigations of D. Brown (*Amer. Jour. Pharm.*, 1893), decomposition is induced by atmospheric oxygen. Chloroform, kept in a Torricellian vacuum, was exposed for several months to direct sunlight, during many hours, without change. Another specimen of chloroform being kept in a bottle, hermetically sealed, after the air was expelled by allowing the chloroform to boil in the glass for several minutes, likewise kept unchanged for 4 months (106 hours' sunlight), while chloroform not preserved with such precaution, and contained in a glass-stoppered bottle, began to decompose in 5 days (12½ hours' sunshine).

In the first stage of the decomposition, oxygen acts upon chloroform, decomposing it into water, chlorine gas, and carbon oxychloride (*phosgene gas*), a gas of a suffocating, nauseous odor, having a much lower boiling point than chloroform—viz.: 8° C. (46.1° F.). The reaction takes place as follows: $4CHCl_3+3O_2=4COCl_2+2H_2O+2Cl_2$. In the second stage, carbon oxychloride reacts with the water present, forming carbon dioxide and hydrochloric acid, as follows: $COCl_2+H_2O=CO_2+2HCl$. This reaction applies only to chloroform free from alcohol. If the latter is present, chlorine, probably in its nascent state, acts upon it, whereby hydrochloric acid is formed. Thus, in the presence of alcohol, the formation of free chlorine may escape notice. Free chlorine will be recognized by its property of liberating iodine from iodide of potassium, or from zinc iodide starch paper. Carbon oxychloride is recognizable by its peculiar smell, which becomes especially noticeable after shaking the chloroformic liquid with mercury, which takes up the free chlorine (Schacht and Biltz). Another test, suggested by Prof. Ramsay, consists in the action of the gas upon barium hydrate (see *U. S. P.* tests below). The following equation represents the reaction: $COCl_2+2Ba(OH)_2=BaCO_3+BaCl_2+2H_2O$.

It is stated by Boettger that fragments of caustic soda will preserve chloroform even in the presence of light, and will restore chloroform containing hydrochloric acid and chlorinous compounds as products of decomposition.

Chloroform is a powerful solvent, and is thus a most valuable auxiliary to the chemist, pharmacist, and manufacturer. It is preferable to ether in many instances on account of its non-inflammability. Still, the fact must be borne in mind that if the vapors of chloroform are mixed with vapor of alcohol or ether, they become readily inflammable. M. Lepage has recorded the qualitative solubilities of a number of substances, such as resins, oils, alkaloids, and chemicals, in chloroform (see *Amer. Jour. Pharm.*, 1852, p. 147). A table of solubilities of alkaloids and alkaloidal salts in chloroform has been compiled by Schlimpert (see *Amer. Jour. Pharm.*, 1860). Chloroform has also become of some importance as an antiseptic. The solution of chloroform in alcohol is precipitated by an excess of water. Potassium and caustic potash have no action upon pure chloroform. With an alcoholic solution of potassa, however, it is decomposed, slowly in the cold, but more rapidly when heated, potassium formate and potassium chloride resulting. Chloroform is also used in the carbylamine test of Hofmann for aniline (see *Anilina*).

Impurities and Tests.—Pure chloroform, not containing *ethylidene chloride* ($CH_3.CH.Cl_2$) and other chlorinated ethyl and amyl compounds, remains unaffected in color when shaken with pure concentrated sulphuric acid. According to Dr. Gregory, these chlorinated pyrogenous oils are the most pernicious foreign matters in chloroform, as they occasion, even when slightly inhaled, pain in the head, unpleasant nausea, etc. To detect these, he directs the addition of 2 or 3 ounces of the chloroform to an equal volume of concentrated and chemically pure sulphuric acid. If the chloroform be pure, the mixture will not be colored, but if these oils be present, the acid will be colored dark-brownish yellow, owing to the quantity of these foreign substances contained in the chloroform.

In testing the purity of chloroform, especial notice must be taken of its specific gravity; if less than 1.49, it contains a mixture of lighter fluids (alcohol, ether, or aldehyde), and, in this case, the volume of such a mixture sensibly diminishes when shaken with twice its bulk of pure water. The presence of alcohol in chloroform may be recognized by various tests—*e. g.*, the iodoform test, *i. e.*, abstracting the alcohol by shaking with water and warming the solution with sodium carbonate and a crystal of pure iodine; if alcohol is present, the smell of iodoform becomes manifest. M. Roussin's test (referred to in the *French Codex*) is said to be extremely delicate, and consists in introducing several grammes of chloroform into a tube or stoppered bottle, then adding a few centigrammes of *nitroso-sulphide of iron*, shaking the mixture, and allowing it to settle. If the chloroform is pure, it remains clear as water; but if it contains alcohol, it assumes a brown tint, more or less deep, according to the proportion present. This reagent will also detect the presence of ether, aldehyde, and methylic and amylic alcohol, it being very soluble in all these compounds. The nitroso-sulphide of iron is procured by mixing a solution of nitrate of potassium with sulphide of ammonium, then, while the mixture is being agitated, dropping in a solution of ferrous sulphate. The whole is boiled, evaporated to dryness, treated with alcoholized ether, filtered, and the solution crystallized.

MM. Béhal and François have recently elaborated a new method to determine the amount of alcohol present in chloroform. It consists in abstracting the alcohol by means of strong sulphuric acid, distilling the ethylsulphuric acid thus formed with water, and oxidizing to acetic acid the alcohol thus regenerated by means of potassium bichromate and sulphuric acid of known strength, according to the method of Nicloux (*Pharm. Centralh.*, 1897, p. 647).

The *U. S. P.* tests are the following: "If 20 Cc. of chloroform be poured upon a clean, odorless filter laid flat upon a warmed porcelain or glass plate, and the plate be rocked from side to side until the liquid is all evaporated, no foreign odor should become perceptible as the last portions disappear from the paper, and the paper should be left nearly odorless when compared with a new, odorless filter. If 10 Cc. of chloroform be well shaken with 20 Cc. of distilled water, and the liquid be allowed to separate completely, the water should be neutral to litmus paper, and should not be affected by silver nitrate T.S. (absence of chlorides), or potassium iodide T.S. (absence of free chlorine). If to about 5 Cc. of chloroform, contained in a dry test-tube of the capacity of about 10 Cc., about 4 Cc. of perfectly clear barium hydrate T.S. be added without agitation, and the test-tube be then corked and set aside in a dark place for 6 hours, no film should be visible at the line of contact of the two liquids (absence of products of decomposition in chloroform which may be otherwise pure). If 40 Cc. of chloroform be shaken with 4 Cc. of colorless, concentrated sulphuric acid in a 50 Cc. glass-stoppered cylinder during 20 minutes, and the liquids be then allowed to separate completely so that both are transparent, the chloroform should remain colorless, and the acid should appear colorless, or very nearly colorless, when seen in a stratum of not less than about 15 Mm. in thickness (absence of impurities decomposable by sulphuric acid). If 2 Cc. of the sulphuric acid, separated from the chloroform, be diluted with 5 Cc. of distilled water, the liquid should be colorless and clear, and, while hot from the mixing, should be odorless, or give but a faint vinous or ethereal odor (absence of odorous decomposition products). When further diluted with 10 Cc. of distilled water, it should remain clear, and should not be affected by silver nitrate T.S. (absence of chlorinated compounds). If 10 Cc. of the chloroform, separated from the acid, be well shaken with 20 Cc. of distilled water, and the liquid be allowed to separate completely, the watery portion should not be affected by silver nitrate T.S. (absence of chlorinated compounds)"—(*U. S. P.*).

Action and Toxicology.—I. INTERNALLY AND SUBCUTANEOUSLY. Chloroform applied to the skin reddens the part, and if evaporation be prevented, vesication is apt to result. Injected subcutaneously in small amounts (10 to 20 minims) it causes some pain at first, followed by a benumbing sensation, which is succeeded by complete anæsthesia of the part, the tissue around the puncture becoming first puffy and then indurated, the induration persisting for many days. Taken internally, it imparts a sweetish, hot, and pungent taste, and if undiluted, may occasion severe irritation or inflammation of the mucous tissues. Hence it is customary to administer it in emulsion or as chloroform water. Heat and inflammation, followed by œdema of the larynx may occur if the concentrated vapor be inhaled during the act of swallowing the drug. In the stomach warmth is first experienced, followed by a cold sensation, and if the drug is not well diluted, a severe gastritis may ensue. Effects not unlike those after the ingestion of alcohol or ether, follow when chloroform is taken in moderate amounts into the stomach—an increased circulation, fullness of the head, giddiness, mental confusion, and brief cerebral excitement or inebriation, succeeded by a soporific state. About 1 drachm subcutaneously, or 1 or 2-drachm doses by mouth, occasion a soporific state, which obtains very slowly, but is singularly prolonged, the drug presumably being very gradually absorbed into the blood. Such a sleep is not accompanied by anæsthesia, for the patient may be very easily aroused, and will again lapse off into sleep. The pulse is slightly slowed, while a reduction in temperature to the extent of 1° or 2° F. is generally effected. A dose of $\frac{1}{2}$ fluid ounce has occasioned alarming symptoms, among which are convulsions, trismus, partial pupillary dilatation, insensibility, retarded and stertorous breathing, frothing at the mouth, livid countenance, bloody stools, and feeble or irregular pulse. Blood may be ejected from the stomach also. Taken in lethal doses, profound stupor, insensibility, and death result. Death results from cardiac paralysis or from asphyxia, or from these and inflammation of the stomach combined. Under chloroform poisoning the pupils may either be contracted or dilated. Usually vomiting occurs, though after large doses no vomiting has taken place. A middle-aged, robust man, but an alcoholic inebriate, poisoned by the ingestion of 1$\frac{1}{2}$ fluid ounces of chloroform, was aroused in 10 hours by the subcutaneous use of two large doses of strychnine ($\frac{1}{15}$ grain, followed in half an hour by $\frac{1}{32}$ grain). Severe gastro-intestinal, hepatic, and renal symptoms followed, the intellect remained clear, and the temperature unaffected, but death occurred in 67 hours from combined cardiac paralysis and pulmonary œdema (Taylor, *Med. Juris.*). The smallest fatal dose recorded was "a drachm or two," which killed a boy of 4 years in 3 hours; 6 to 7 drachms is the smallest fatal dose in an adult. A fluid ounce has frequently killed, and the time required to produce death generally ranges from 1 hour to 8 days (Taylor, *Med. Juris.*).

The post-mortem appearances are congestion and inflammation—congestion of the brain and pulmonic structures, and congestion, inflammation, and ulceration of the gastric portion of the gastro-intestinal tract—the intestinal portion usually presenting nothing marked except some congestion and the odor of the drug. The bronchiæ are bathed with sanguineous mucus or muco-pus. Coagulation of the blood is prevented, that liquid being found unusually fluid in the vessels. The post-mortem appearances are not, as a rule, constant. Poisoning by swallowing chloroform must be met by emetics, the stomach-pump, or siphon; the further treatment is that of narcosis by inhalation. On account of its burning taste and pungency, it is rarely selected for suicidal purposes.

II. INHALATION AND ANÆSTHESIA.—The effects usually occasioned by anæsthetic doses of chloroform are, whizzing and pulsation in the head, a change in the apparent color of objects, pleasurable ideas and visions, loss of consciousness, incoherent talking or muttering, and sometimes loud or noisy respiration, muscular relaxation, and complete insensibility to pain, from whatever cause. A minute or two generally suffices to occasion anæsthesia, which will last for several minutes, but may be continued for an indefinite period, by carefully repeating the inhalation at certain intervals of time, as its influence is observed to be decreasing. Sometimes, from the coughing produced, or other circumstances, it may require a long time before its anæsthetic effect is induced, but which may be obviated by holding it, at first, at a little distance from the nostrils, that it may be mixed with atmospheric air, and then gradually approaching it to them. Its anæsthetic influence is succeeded by somnolence, or a calm slumber, and usually there is no remembrance of incidents which happen during the anæsthesia.

The full anæsthetic effects of chloroform are always attended with great hazard; it has been ascertained that it may be administered to an extent sufficient to produce torpor of the nerves of sensation without completely destroying consciousness, so that, in some cases, it may be unnecessary to risk the production of an entire suspension of the mental powers. Generally, however, it is unsafe to operate until complete unconsciousness has been effected, a majority of the fatal accidents from chloroform inhalation having been observed in minor operations where incomplete anæsthetization had been practiced. It is probable that the fatalities attending the extraction of teeth, etc., are in part due to the fact that the drug was inhaled in the sitting posture; and that many deaths from chloroform have been hastened by fear. In inhaling chloroform, the article should be pure, as the presence of pyrogenous oils occasion vomiting; this effect is also apt to occur if the chloroform be inhaled immediately after a full meal. About a fluid drachm is the quantity generally used at a time for inhalation, and this should be renewed every 3 or 4 minutes until the required effect takes place. The only apparatus needed to inhale chloroform is a handkerchief, closely, but not too tightly, rolled up, and held in the hand, having a concavity into which the chloroform is poured, and then placed near, but not immediately in contact with, the mouth and nose. A quantity of common air should always be allowed to enter the lungs with the chloroform vapor. *It is never safe to administer chloroform vapor in greater proportion than 3½ per cent, the rest being atmospheric air.* It should be remembered that the vapor of chloroform is heavier than air, so that it should not be held too close to the nostrils, lest the air should be wholly replaced by it. As soon as the requisite amount of insensibility occurs, its inspiration should be discontinued, and only carefully repeated when there is too early a restoration to consciousness. Epileptics, those laboring under disease of the heart, those predisposed to apoplexy, or cerebral determinations, and persons who have recently lost much blood, should not be placed under the anæsthetic influence of chloroform. It should never be administered immediately after a hearty meal, as it may cause vomiting; and when the pulsations fall below 60, the inhalation should be stopped. Excitement, which often marks the first degree of insensibility, is a mark that the handkerchief should be removed and not kept on, as is generally practiced. Violent excitement, and the exclamation, "I am choking," should be followed by the immediate removal of the handkerchief. The patient should be in the recumbent position, the head slightly raised by a pillow, and he should be frequently asked, while he is being pinched, what is done to him; and when he begins to answer with ill humor, "you pinch me," he is on the point of losing sensation. As soon as he answers no more, sensation is abolished, the handkerchief should be immediately removed, and the operation at once commenced, without waiting for a complete resolution of the muscles (M. Baudens). Some, however, prefer to wait for muscular relaxation, stopping short of stertorous breathing.

Before beginning the administration of the anæsthetic, certain precautions should be taken. All the implements to be used in the operation should be concealed from the patient's view, and all the necessary implements and restoratives deemed necessary in case of an accident, should be at hand, and also out of the patient's sight. The patient's chest should be bared, his fears allayed, and his confidence gained by the necessary explanations. Care should be taken that the clothing does not in any way constrict the circulation, nor should the administration be commenced after a full meal, nor after a long fast. The recumbent position must be maintained always. The administrator should attend to the administration of the anæsthetic, and to that alone. No talking nor noises, as the rattling of instruments, should be allowed, and there should be an abundance of fresh air admitted into the operating room. If desired an ounce of brandy or whiskey may be administered previous to the administration of the anæsthetic, or a hypodermatic injection of morphine, as suggested by Bernard, may be administered. The latter is said to render the process of inhalation quieter, and to lessen, and in some cases prevent the stage of spasm and rigidity nearly always present in the strong and robust, while it is also believed to antagonize the paralytic action of the chloroform upon the heart and lungs, and to prevent the shock succeeding the chloroformization and the operation performed. To prevent irritation and subsequent swelling of the nostrils and lips, the parts should be anointed with oil or petrolatum previous to the administration of the anæsthetic. Certain organic changes should be taken into consideration. Anæsthesia should not be attempted in those suffering from fatty and other degenerate conditions of the heart; it is inadmissible in feeble and obstructed heart, though it has been safely given where only valvular lesions exist, without change in the heart-muscle or cardiac ganglia, with apparent safety. The same is true of phthisis (Bartholow). Organic lesions of the brain, as cerebral tumors or abscesses, tendency to apoplexy, epilepsy, and obstructive lesions of the kidneys, are also contraindications to its anæsthetic employment. Beside the previous named conditions, anæsthesia is improper in aneurism, chlorosis, most cases of phthisis, chorea, and anemia. We should be cautious in using it, if indeed, we should use it at all, where the tonsils are markedly enlarged, or when the epiglottis is swollen, or œdema of the glottis is present. It is a dangerous procedure to produce anæsthesia in old topers, a fatty heart generally being present; and the inhalation of chloroform is likewise inadvisable in delirium tremens.

Great care should be exercised in the administration of the anæsthetic. The pulse, and particularly the respiratory movements should be carefully and continuously noted. Sudden pallor of the countenance and sudden and complete dilatation of the pupils are signs of the gravest danger. Stertorous breathing is the danger signal of respiratory paralysis, and when it occurs the chest should be vigorously slapped, as taught by Prof. Howe, until respiratory movements become free again. Children bear chloroform anæsthesia better than adults; women better than men; feeble persons and those reduced by long sickness better than the robust and healthy. This latter statement is disputed by some. It seems, however, that anæsthesia for operations upon diseased parts is better borne than when employed after injuries. Probably the shock and the terror attending the latter have much to do with the untoward action of the anæsthetic.

Much discussion has been made as to the method in which chloroform produces death, the belief formerly prevailing that it was nearly always due to cardiac paralysis. The first (1889) and second (1890) Hyderabad Commissions combated this view of its action upon the heart, and claimed that the lungs were the organs mainly and primarily involved. The experiments of this body, however, were performed in India and upon dogs. European and American observers have vigorously combated this theory of primary respiratory paralysis, the majority of deaths in Europe and America resulting from cardiac paralysis. Again, it shows the futility of trying to infer the action of a drug upon man because of certain effects produced in the lower animals. Indeed, it is not uncommon for entirely different effects to be produced upon man and animals by the same drug. Prof J. A. MacWilliam (*Brit. Med. Jour.*, 1890), has recently shown that chloroform directly affects the heart substance, and that death from cardiac failure is the rule, the mode of failure being due to a more or less sudden dilatation of both sides of the heart, with marked enfeeblement of that organ, the feeble state and distension of the heart, which is unable to propel the blood, explaining the failure of artificial respiration to revive the patient. He shows that respiration may continue for several minutes after the heart has ceased to beat. The ground occupied by Wood (1890), Laborde (1890), Reeve, Hare, Dunlop, and others, is probably nearest to a correct solution of the lethal action of the drug. According to these observers, death may take place either from primary cardiac or from primary pulmonary paralysis, either taking place independently of the other. Thus death may result either from asphyxia or syncope. Dr. Wood maintains that while ether more generally acts upon the respiratory, more strongly than upon the circulatory organs, it may occasionally also produce death by heart paralysis. The treatment for chloroform narcosis, then, includes methods for sustaining both the cardiac and respiratory functions.

When administering chloroform, the operator ought always to be provided with a bottle of strong aqua ammoniæ, and whenever unpleasant symptoms arise, the patient should be made to inhale it from another handkerchief imbued with it, in the same manner as named for chloroform, and be either restored to sensibility, or not, as the case may require.

If the accident be due to respiratory failure, artificial respiration should be resorted to, and strychnine injected, or nitrite of amyl or ammonia inhaled. In case the tongue should tend to fall back into the throat, it should be drawn forward out of the mouth. The body should be placed head downward (Nelaton's method) in cardiac failure, to allow the blood to pass freely to the brain, and atropine, strychnine, and, best of all digitalis, administered hypodermatically. The latter is probably the best agent that can be employed. The use of alcoholics is questionable, as small quantities do no good, while large amounts aid in embarrassing respiration. External heat should be applied and cold affusions avoided. Recently it has been shown that forcible and sudden dilatation of the anal sphincters will relieve patients from chloroform narcosis. While this has been ridiculed, we have the testimony of competent observers that it is signally effectual, operating probably through shock to the sympathetic nervous system.

Chloroform Habit.—Chloroform continuously consumed for the purpose of producing inebriation, as it often is, is more pernicious in its effects and more intractable to treat than the opium habit. Enormous quantities, as much as a pound, have been consumed in a day, but life can not long resist such amounts. Occasionally only acute symptoms lasting a week or so, and characterized by hallucinations of sight and sound, noisy delirium and furious maniacal raving may be the effects. More often, however, a chronic form ensues, with mental irritability, melancholia, or hypochondriasis, delirium, and early decay of the intellectual powers. The worst phases of moral depravity may also be exhibited. Fortunately, this use of the drug soon destroys its victims.

Comparison of Ether and Chloroform.—Chloroform is now very largely used by inhalation as an anæsthetic agent, and from the small quantity required, the promptitude with which it influences the system, its rather pleasant action, its more agreeable and less persistent odor, its moderate price, and the facility with which it may be administered, many in this country prefer it to ether, notwithstanding its greater danger. On the continent its seems to be losing ground, ether being preferred. The fact that chloroform is a much more dangerous anæsthetic, producing fatal results about 4.5 times as often as ether, makes the latter the more desirable agent to use in all operations where it is desired to produce anæsthesia. The majority of surgeons, and many of those who use chloroform, admit the greater safety of ether. Dr. Thomas Jones, of St. George's Hospital, London, who, in the course of eleven years, had administered chloroform to over 6,000 individuals, declared that if he were unfortunate enough to have to be anæsthetized, nothing could induce him to take chloroform. In obstetricy, however, chloroform is remarkably free from dangerous results, much more so than in any other condition, and is always preferred to ether in obstetrical manipulations.

A comparative table will show the advantages of ether over chloroform, while it will be observed that if equally as free from danger as the former, the latter would, from its pleasanter and prompter effects, be far preferable to the former.

Ether.	Chloroform.
Unpleasant odor.	Agreeable odor.
Unpleasant to inhale.	Pleasant to inhale.
Inflammable, and can not well be used around fire and lights.	Non-inflammable and safe around fire and lights.
More irritant to the air passages.	Less irritant to the air passages.
May be given more rapidly.	Must be slowly administered.
Air should be excluded as much as possible while administering.	Air to the extent of at least 97½ per cent should be mixed with the anæsthetic vapor.
Its vapor may be inhaled almost in full strength.	Not more than 3½ per cent with the inhaled air is safe.
Reduces temperature several degrees.	Practically no reduction of temperature.
More apt to occasion pugnacity, or lascivious or vulgar talk.	More apt to render the ideas and visions pleasurable, the incoherent talk being of a pleasant and not vulgar character.
Not contraindicated by mere feebleness of heart.	Not admissible in weak heart.
More irritant to the kidneys and lungs.	Less irritant to the renal and pulmonary tissues.
Action less prompt and more transient.	Effects more prompt and more prolonged
Comparatively free from danger.	Always dangerous.
Kills chiefly by respiratory paralysis; occasionally by heart failure.	Kills chiefly by cardiac paralysis; and quite often primarily by asphyxia.
Danger easily detected by color of face and ears, and state of pulse in sufficient time to resort to artificial respiration, by which death may be averted.	Danger signs, as of pulse, pallor, etc., exhibited as quickly as with ether, but too late to be of value if cardiac paralysis has occurred.
Death occurs in proportion of about 1 to 17,000.	Death occurs in proportion of about 1 to 4,000.
Claimed never to be dangerous when properly administered.	Admitted to be dangerous, even by its advocates.
Should always be preferred in long operations.	Preponderance of opinion in favor of never using where ether may be employed.
Less used in obstetricy.	Preferable in obstetric manipulations.

Notwithstanding its dangerous character, Prof. A. J. Howe was a strong advocate of chloroform, and in his incomparable article on ANÆSTHESIA (*Art and Science of Surgery*, pp. 38 to 51), states: "I have administered chloroform over 5,000 times, and have been so fortunate as not to have a death occur from the anæsthetic." He states that he has always succeeded in resuscitating the patient in handling several cases in which startling symptoms were exhibited, by his method, now well known to Eclectic practitioners, viz.: "Turning the patient on his face and forcing a finger deep in the throat to remove collections of mucus or material that is vomited, may clear the way for respiration which must be kept up artificially. While the patient lies upon his abdomen, the chest is to be turned every few seconds from one side to the other, and heavy slaps are to be imparted to the thorax just below the scapulæ. Blowing in the mouth is then to be quickly performed, and the turning and slapping renewed. Every few minutes the finger is to be forced deep into the pharynx, and the tongue pulled forward as the digit is removed. Efforts of the nature above described are to be kept up until no hopes of resuscitation remain. The manipulation favors a return of the heart's action and respiratory changes. If the feeble vital spark can be kept unextinguished there is a possibility of resuscitation. I once worked over a child for an hour, and my labors were rewarded by complete recovery" (Howe's *Surgery*, p. 48–9).

To obviate the alarming effects of chloroform, Dr. Warren proposed a mixture containing 2 parts of anhydrous alcohol, and 1 part of pure chloroform. This mixture is considered less dangerous than chloroform and more pleasant than ether. The suggestion that either alcohol or ether, by their stimulating qualities, overcome the prostrating effects of the chloroform, when in combination with it is probably correct (see Warren, "*On the Effects of Chloroform and Chloric Ether*"). However, nearly all modifications, such as the A C. E. mixture, etc., have now been largely discarded, either pure ether, or chloroform, being employed singly.

Medical Uses and Dosage.—I. INTERNALLY. Internally, chloroform is a stimulant, sedative, antispasmodic, and anæsthetic. It has been used successfully in *asthma*, *spasmodic cough*, *scarlatina*, *atonic quinsy* to relieve the pain, *hysteria*, and to allay the pain in *lead colic*, *biliary* or *renal colic*, passage of *renal calculi*, *gastralgia*, *gastric ulcer*, *atonic dyspepsia*, *cancer*, *neuralgic affections*, and to avert chills in *intermittents*. It may be administered in doses of from 30 to 80 drops in solution of gum Arabic, or in a mixture of water and yolk of egg, repeating the dose if required, every ½ hour, hour, or 2 hours, until it has occasioned the desired influence. Spirit of chloroform is an eligible preparation. The solution of camphor in chloroform is an elegant form of administering that medicine. Dr. T. H. Buckler recommends chloroform in teaspoonful doses every hour during the pain, and 3 times a day subsequently, as a preferable solvent of cholesterin in *biliary calculi;* to be followed by the use of the hydrated succinate of iron, to check the further formation of these calculi. Whether it dissolves the calculus or not, it certainly relaxes the spasm of the tube through which it passes, thus effectually allaying the pain. *Nausea* and *vomiting* where no inflammation is present, as of *sick headache*, *sea sickness*, *pregnancy*, etc., may often be relieved by giving from 2 to 5 drops of chloroform on sugar. Added to cough mixtures it aids in controlling *nervous cough*. Internally, a full dose administered just before the chill, may cut short a paroxysm of *intermittent fever*, and a few drops of chloroform, or better of chlorodyne, frequently arrests the symptoms of *Asiatic cholera*. While inhalations of chloroform are inadmissible in old topers and in *delirium tremens* its internal use is valuable where marked depression is present. ℞ Chloroform, flʒj; diluted alcohol, fl℥xij; tinct. capsicum, fl℥xiij. Mix. Sig. Teaspoonful doses in water. From 10 to 15-drop doses of the same are useful in *flatulent colic* and *hiccough*.

EXTERNALLY.—Externally, it has been employed in several forms of disease, and has been beneficially used as a local application to *gangrenous* and *cancerous ulcerations*, *dry gangrene*, *ulcerations of the mouth and fauces*, and in *copious uterine secretions*. It allays pain, corrects putrescent odors, and hastens the sloughing process; 1 or 2 fluid drachms of chloroform added to a pint of water, will answer for these purposes (Tuson). When a sponge, moistened with it, is placed in proximity with the os uteri, it has relieved *painful menstruation* (Higginson); applied to the sacrum, it has relieved the same disorder, and has also proved serviceable

able when applied externally in *tic-douloureux*, *rheumatic affections of the eye*, *soreness of the spinal column*, and in *orchitis*. The vapor applied directly to the part will often relieve the pangs of *sciatica* and the suffering from *myalgia*, *lumbago*, and *nervous headache*. Where the area is small, as in the latter, a little chloroform may be poured into a watch-glass and the latter inverted upon the part, as the temple. Applied in this way, or upon a folded handkerchief, it is effectual in localized *neuralgias*, as of the face. The vapor should be kept in contact until the pain is relieved. Prof. Locke recommends (*Syllabus of Mat. Med.*) the following as an efficient and elegant liniment for the relief of pain: ℞ Chloroform, flʒvj; tinct. aconite, flʒii; spirit of camphor, fl℥ijss; glycerin, fl℥ss. Mix. Sig. Rub on the painful part. Another excellent liniment is the following: ℞ Chloroform, tinct. aconite, aa ℥j; soap liniment, ℥ii. Mix. Sig. Apply on flannel and cover with oil silk. Thirty minims of chloroform, mixed with 5 drachms of lard, has been employed as an ointment in *cutaneous eruptions* of a papular character. When applied to the uninjured skin there is no necessity for diminishing the strength of chloroform; a piece of lint moistened with it may be applied to the part, and its volatilization may be retarded by covering this with several thicknesses of muslin, India-rubber cloth, etc. If the chloroform is rendered impure by the presence of anhydrous alcohol, it is thereby rendered caustic (Mialhe). In *earache*, from *acute catarrh of the middle ear*, the vapor may be cautiously passed into the external meatus by means of an insufflator; the escape should not be prevented, however, lest the part be blistered. Therefore it should not be introduced on cotton. In both *mastodynia* and *mammitis* its local action has given relief, and applied to the perineum in *labor*, it has controlled the severe pain and relaxed the rigidity of the parts. Applied to the epigastrium it has relieved cases of *cholera morbus*, and over the abdomen it has allayed painful affections and spasms of the viscera. *Rheumatic toothache* may be palliated at least by rubbing the gum with chloroform, while camphorated chloroform will often alleviate pain from *dental caries*, if applied to the cavity on cotton. Deep subcutaneous injections, first employed by Bartholow, have been used to give relief in *neuralgias*, particularly of the trifacial nerve. The injection should be deep, and near the sheath of the nerve trunks. Induration follows where the needle is introduced, and occasionally abscess. Injection into the gums is asserted to frequently cause gangrene. A pledget of cotton, moistened with pure chloroform, has been introduced into the external auditory canal for the relief of the *photophobia* accompanying *interstitial keratitis*. It acts by anæsthetizing the Gasserian ganglion (Gutieroz-Ponce). A chloroform liniment has been made of oil of almonds, 2 fluid ounces; chloroform, 2½ fluid drachms; mix accurately. Pieces of flannel are to be soaked with this liniment, and applied to the painful part in cases of *nervous headache*, *neuralgia*, *rheumatic*, *hepatic*, *nephritic*, *uterine* or *intestinal pains*, *lead-colic*, etc. By adding double the quantity of oil, it may be used for vaginal injections, which may be retained by a plug of cotton, in cases of *dysmenorrhœa*, *uterine neuralgia*, or other painful affections of the uterus, bladder, or rectum.

Gelatinized chloroform has been recommended as an application by friction, or on compresses, to cause insensibility of the skin; it may be prepared in a few minutes, by agitating together the white of an egg with four times its weight of chloroform, and then setting the bottle containing the mixture in water having a temperature of 60° C. (140° F.). A weaker preparation, requiring 3 or 4 hours for the gelatinous change to occur, is made by agitating, in the cold, equal parts of white of egg and chloroform. Fournie states that equal measures of chloroform and glacial acetic acid form a mixture, the vapor from which will produce complete anæsthesia of the skin in a very few minutes.

III. BY INHALATION.—Chloroform was in use as an internal remedy for years before it became known as an anæsthetic. It was, however, used by inhalation in a case of *pulmonic embarrassment* as early as 1832. At the instigation of Mr. Waldie, of Liverpool, who had experimented with it in 1838–9, it was adopted and used first as an anæsthetic in November, 1847, by Dr. Simpson, of Edinburgh, who had been looking for a substitute for ether.

Chloroform is used to produce *anæsthesia*, to *relax spasm*, and to *alleviate pain*. Certain *respiratory neuroses* are relieved by its inhalation. In the same manner it may be used to give relief in the various forms of *colic*—, *bilious*, *flatulent*, *renal*, etc.:

dysmenorrhœa, *neuralgia*, *tic-douloureux*, *cancer*, and other painful states. For these purposes full anæsthesia is never required. It may be used in excited states, as in *hysteria*, *puerperal mania* (when not due to cerebral hemorrhage), *chronic insanity*, and *maniacal excitement*, and is extremely valuable in many *spasmodic disorders* of the muscular and nervous systems, many of which are also painful. Thus it is one of the best agents in *hiccough*, *convulsive hysteria*, *chorea*, *tetanus*, *hydrophobia*, and other *convulsive disorders*. In *asthma*, though it may not cure, it is unfailing as a palliative. It loses its power, however, after many repetitions of its use. It relieves severe *whooping-cough* and *convulsions* arising from cough. In *laryngismus stridulus* its effects are prompt. In *infantile convulsions* it is certainly one of the best agents to overcome the spasm, so that indicated drugs may be given to avert a return of the convulsive attacks. During the passage of *gall stones* and *renal calculi*, it not only relieves pain, but relaxes the spasmodically contracted tubes, thus facilitating the passage of the offending body. It is by far the best agent to control *uræmic spasms* or *convulsions* from the same cause following *scarlatina*, while it stands at the head of all agents to check *puerperal eclampsia*. Morphine should also be hypodermatically injected. By the use of chloroform time is gained in which to administer other and appropriate remedies. It should not be forgotten as an aid in *poisoning by strychnine*. When no organic disease of the heart exists, the inhalation of chloroform will relieve *angina pectoris*, but the condition of the heart should be carefully ascertained before risking the agent. Amyl nitrite, followed by lobelia, is preferable.

Chloroform is principally used in *surgery* and *midwifery*, as an anæsthetic, for the purpose of producing insensibility to, or relieving pain and facilitating labor. In the latter state, it seems to be far safer than in any other condition. When labor is normal, brief, and not very painful, its use should be avoided. If, however, the opposite be true, no agent will act more beneficially and none will be more greatly appreciated by the woman. In first labors it should be used with great care. It is seldom necessary to carry it to complete anæsthesia, in fact, it should seldom be carried beyond the stage of merely blunting sensibility. It mitigates the pains, though it does not interfere with the force and frequency of the contractions, when not pushed too far, while it promotes relaxation of rigid parts. Pushed too far it interferes with the contractions and favors hemorrhage. Its use favors the easy performance of the required *obstetric operations*, as *turning*, *applying forceps*, *changing positions*, *extracting retained placentæ*, or other manipulations, unless the patient be enfeebled by hemorrhage. If the latter state be present, and the agent must be employed, it should not be used to complete unconsciousness. In turning, enough must be given to suspend uterine action, while in forceps delivery enough should be administered to quiet the patient, or if necessary, to accomplish complete relaxation of the muscles. In instrumental interference it tends to prevent shock. In *craniotomy*, *symphyseotomy*, or *Cæserian section*, the woman should be fully under the influence of the vapor. In most cases of labor a few whiffs of chloroform are allowed by many practitioners just as the head is emerging from the vulvar aperture.

Chloroform is of great value in facilitating *diagnosis*, where a thorough examination is necessary. It prevents pain, thoroughly relaxes the parts, and does away with any objections that might otherwise be made by the patient. It is especially useful to aid in determining obscure *abdominal*, *genito-urinary*, *pelvic*, and *rectal disorders*, and in examining *fractures* and *dislocations*. It is likewise useful in detecting *feigned diseases*.

By far the greatest use of chloroform has been to render *surgical operations* painless. Either this agent or ether is employed in all great operations. It may be used in performing *amputations*, *extirpating tumors*, in the reduction of *herniæ*, adjusting *fractured bones*, *reducing dislocations* (almost absolutely necessary here, to overcome muscular resistance), to rend *adhesions*, overcome *muscle* or *tendon contractions*, in performing *orificial work*, to correct *deformities*, and in dressing painful *ulcers* and *wounds*. Not only does it relieve the pain, but it also removes the fear and anxiety of the patient, and overcomes that muscular tension or rigidity which would otherwise defeat the surgeon in accomplishing a perfect result.

Prof. A. J. Howe, M. D., states that he has for some years been in the habit of administering chloroform, by inhalation, to break the force of *chills*. If given when a chill is coming on, a condition foreshadowed by gaping and other well-known signs, the influence of the anæsthetic will prevent the paroxysm. He does not pretend that it eradicates the poison which causes the chills, or in any way takes the place of quinine, but by preventing or breaking up a paroxysm, time is gained in which to get an action from antiperiodic remedies. Dr. O'Bryan recommends a mixture of 10 drops, each, of laudanum, tincture of aconite, and chloroform, as being almost a specific in *intermittents*. It may be given 3 times a day for 7 or 8 days, during the intermission, preceding its use by a purgative.

The dose of chloroform is from 2 minims to 2 drachms; spirit of chloroform, from 10 to 60 minims, well diluted; chloroform water, ½ to 2 fluid ounces; emulsion of chloroform, 1 to 5 drachms. For anæsthesia, by inhalation, the amount will be indicated by the effects produced. Dr. Thos. Skinner, of Liverpool, recommended the following preparation for internal use: *Spiritus Formyli Terchloridi* (commonly called chloric ether). Chloroform, 5 fluid drachms; alcohol, specific gravity 0.838 at 15.5° C. (60° F.), 1 pint. Mix. Dose, ½ to 2 fluid drachms, in a sufficient quantity of water.

Specific Indications and Uses.—To produce anæsthesia for surgical purposes; to alleviate pain; to relax spasm and control convulsions; to dissolve biliary calculi (?); to check severe and protracted chills (gtt. x to xx.).

Related Products.—Chlorodyne. An empirical preparation under the name of *Chlorodyne*, has been somewhat popular in the profession of England and this country, as a remedy in *Asiatic cholera;* it is said to possess anodyne, diaphoretic, antispasmodic, and astringent properties. It is very effectual in many *painful states of the viscera*, and is prompt in its effects in *menstrual colic*. From 5 to 10 drops every hour until relief is obtained, is effectual to allay the frequent and painful micturition of *chronic cystitis*. As there are on the market many preparations bearing the name *Chlorodyne*, and nearly all varying in their composition, their strength should always be ascertained before administering them. Several formulæ for the preparation of chlorodyne have been published, from which the following are selected: Agitate together sulphate of morphine, 64 grains; alcohol (95 per cent), 2 fluid ounces; and purified chloroform, 6 fluid ounces; then gradually add sulphuric acid q. s. to make the mixture clear upon agitation; add oleoresin of capsicum, 12 drops; extract of cannabis indica, 30 grains; and Scheele's hydrocyanic acid, 96 drops. This forms a clear, dark, green liquid, each teaspoonful of which contains 1 grain of sulphate of morphine, about ½ grain of extract of cannabis, and 1½ drops of prussic acid, equal to nearly 4 drops of *U. S. P.* acid. The dose is from 15 to 30 drops. This preparation is said to be preferred to the original one by Dr. J. Collis Brown. But it must be used with care, as it must be extremely poisonous (E. McInall, Jr., *Amer. Jour. Pharm.*, 1868, p. 209). A less dangerous preparation was proposed by Prof. E. S. Wayne, as follows: Aqueous extract of opium, 12 grains; extract of hyoscyamus, 8 grains; oil of peppermint, 5 minims; oil of capsicum, 1 minim; camphor, 10 grains; alcohol, 4 fluid drachms; glycerin, 2 fluid drachms; chloroform, 2 fluid drachms. Mix.

Choramyl.—Chloroform, 1 pound; amyl nitrite, 2 drachms. Mix (Sanford).

Chlor-anodyne.—This pharmaceutical preparation was devised and introduced by Parke, Davis & Co., of Detroit, and as made by them enjoys an enviable reputation. The formula is published in their literature, and is freely given to whoever wishes to study either its composition or its therapeutical action.

Lycoperdon.—The fumes from burning the common puff ball (*Lycoperdon Bovista*, Linné) are said to be anæsthetic, but not equal to ether or chloroform. It possesses a volatile narcotic principle, which is not taken up by alcohol, water, or strong alkaline solutions (see p. 364).

CHONDRUS (U. S. P.)—CHONDRUS.

Chondrus crispus, Stackhouse (*Sphærococcus crispus*, Agardh; *Fucus crispus*, Linné), and *Gigartina mamillosa*, J. Agardh (*Sphærococcus mamillosus*, Agardh; *Mastocarpus mamillosus*, Kützing; *Chondrus mamillosus*, Greville).

Class: Algæ.

Common Names: *Irish moss*, *Carragheen*, *Caragahen*, *Carragahcen*.

Botanical Source.—*Chondrus crispus*, Stackhouse. Irish moss, sometimes called *carrageen*, has a root-disk, throwing up tufts of many flat, nerveless, slender, cartilaginous fronds, from 2 to 12 inches in height, subcylindrical at the base, but immediately becoming flat, generally dilating from the base upward, until they become 3 or 4 lines wide, then dividing repeatedly and dichotomously, each division spreading and becoming narrower than the preceding one, and taking place at shorter and shorter intervals; the summits are bifid, the segments linear, wedge-shaped, varying greatly in length, rounded or acute, straight or curved, often twisted in such a manner as to give the curled appearance denoted in the specific name. The fructification is roundish or roundish-oval, and subhemispherical. The capsules are imbedded in the disk of the frond, prominent on one side, producing a concavity on the other, containing a mass of minute, roundish, red seeds. The substance is cartilaginous, in some varieties approaching to horny, flexible, and tough. The color is a deep purple-brown, often tinged with a purplish-red, paler at the summit, becoming greenish, and at length white in decay (L).

Gigartina mamillosa, J. Agardh. This plant differs chiefly from the preceding in the situation of its cystocarps (sporocarps or capsules), which, instead of being slightly raised and near the extremities of the segments, as in the foregoing species, are borne on short, tuberculated projections or stalks, scattered over the channeled thallus.

History.—These are very common European plants found along the seacoasts, especially along the west shores of Ireland, where quantities of it are gathered. They also grow on the Atlantic shores of this country. Large quantities of Irish moss are annually collected on the Massachusetts coast. It is found attached by its disk to the rocks along the sea, where it is collected in the spring-time, washed, and spread on the sands some distance from the shore-line, and allowed to lie in the sun until it becomes well bleached and of translucent, horny texture, when it is ready for market. It was introduced into medicine in 1831, by Todhunter, of Dublin. *Carrageen* (more properly *carraigeen*) signifies, in Irish, "moss of the rock" (*Pharmacographia*). It is used to some extent in the arts, as sizing for paper and cotton fabrics in calico printing, for filling mattresses, and in this country in making beer. Cattle are sometimes fed on it (*Pharmacographia*). When fresh its color is somewhat purple, but when cleansed, and dry, as met with in commerce, it is in long crispy pieces, yellowish, or dirty-white, nearly inodorous, and of a mucilaginous taste. It swells up in warm water, and almost entirely dissolves in boiling water, forming a jelly when cold.

Description.—"Yellowish or white, horny, translucent; many-times forked; when softened in water, cartilaginous; shape of the segments varying from wedge-shaped to linear; at the apex emarginate or 2-lobed. It has a slight sea-weed odor, and a mucilaginous, somewhat saline taste. One part of it boiled for 10 minutes with 30 parts of water yields a solution which gelatinizes on cooling, and is not colored blue by iodine T.S."—(*U. S. P.*).

Chemical Composition.—Irish moss contains oxalate of calcium, compounds of sulphur, iodine, chlorine, bromine, potassium, magnesium, and sodium, and a large portion (as high as 80 per cent), of pectin matter. Flückiger, however, failed to find sulphur in the mucilage. Though starch is not present, Flückiger has shown that if thin pieces of the moss be treated for one day with solution of caustic potash in alcohol, the cell-contents (not cell-walls), react with a dark-blue coloration with the iodide of potassium iodine solution (*Pharmacographia*). Pereira considered the pectin to be a peculiar modification of mucilage, and has called it *carrageenin*. Carrageenin may be known from gum by its watery solution not affording a precipitate on the addition of alcohol; from starch by its not assuming a blue color with tincture of iodine; from animal jelly, by tannin causing no precipitate; and from pectin by acetate of lead not throwing down anything, though mucic acid is formed by the action of nitric acid.

Action, Medical Uses, and Dosage.—A decoction of Irish moss, with water or milk, is very nutritious, and may be used as a demulcent in *chronic affections of the air passages*, *chronic diarrhœa* and *dysentery*, *scrofula*, *rickets*, *enlarged mesenteric glands*, *irritation of the bladder and kidneys*, etc. As a culinary article it may be employed in the preparation of jellies, white soup, blanc mange, etc. The decoction is prepared as follows: Macerate ½ ounce of carrageen in cold or warm water, during 10 minutes; then boil in 3 pints of water, or milk if stronger nourishment is desired, for a quarter of an hour. Strain through linen. Sugar, lemon-juice, tincture of orange-peel, essence of lemon, or other aromatics, as cinnamon or nutmeg, may be employed as flavoring ingredients.

Related Species and Drugs.—Other species of algæ are said to be collected with the true Irish moss, the *Gigartina acicularis*, Lamouroux, having small, cylindrical segments, and having been sold in France as carragheen (Dragendorff). Another species resembling carragheen is the *Gigartina pistillata*, Lamouroux.

CEYLON MOSS, *Fucus amylaceus, Jaffna moss, Edible moss.*—The *Sphærococcus lichenoides,* Agardh. Irregularly dichotomous, cylindrical, terminating in filiform extremities, of a reddish color (fresh); whitish and brittle when dried. Mucilaginous to the taste, and possessing a faint odor of sea-weed. A delicate moss from 4 to 10 inches in length Contains metarabin, gelose, paramylon, cellulose, gum, other carbohydrates, some soluble in boiling water, others in soda solution, ash, albuminoids, and a substance soluble in alcohol (H. G. Greenish, 1882). This moss is collected from the Indian Ocean (Ceylon coast), and is one of the algæ consumed by the *Collalia esculenta* (*Hirundo esculenta*), and other species of swallow of the East Indies, and after having been changed in the bird's gizzard, is made to enter into the formation of their nests, which constitute the EDIBLE BIRDS' NESTS of the Chinese. Ceylon moss is used like Irish moss.

AGAR AGAR.—This term is applied to several edible sea-weeds of the East Indies, and some of these varieties, largely employed by the Chinese for sizing silks and preparing jellies, have received commercial names as follows: *Chinese* (or *Japanese*) *isinglass,* or *gelatin,* derived chiefly from *Gelidium corneum,* Lamarck; and from *Eucheuma spinosum,* Agardh; *Eucheuma gelatinæ,* Agardh; *Gelidium cartilagineum,* Gaillard; *Sphærococcus compressus,* Agardh; *Gloiopeltis tenax,* J. Agardh, and other algæ. This variety occurs in strips about a foot long, or in slender pieces a couple of feet in length, and of a yellow-white color. The strips are employed in bacteriological investigations. It is employed for the same purpose as jellies prepared from animal tissues, and its chief gelatinizing agent is *gelose* (Payen), a substance having greater gelatinizing properties than *carrageenin.*

Celebes or *Macassar agar agar.*—The salt-incrusted *Eucheuma spinosum,* Agardh, and *Eucheuma gelatinæ,* Agardh, gathered in the straits between the Celebes Isles and Borneo, and occurring as a brown-white moss, with sharp projections on its segments. It contributes to the preparation of Chinese gelatin (see above).

CORSICAN MOSS or HELMINTHOCORTON.—A mixture of a number of sea-algæ gathered in the Mediterranean, one species of which, at least, is the *Sphærococcus Helminthocorton,* Agardh, (*Gigartina Helminthocorton,* Greville; *Fucus Helminthocorton,* Linné). The latter has a cartilaginous, terete, tufted, entangled frond, with setaceous branches, is somewhat dichotomous, and marked indistinctly with transverse streaks. The lower part is dirty-yellow; the branches more or less purple (L.). This is a marine plant, growing on the Mediterranean coast, and especially on the Island of Corsica. The plant is of a cartilaginous consistence, of a dull and reddish-brown color, has a bitter, salt, and nauseous taste, and its odor is rather pleasant. It is found in the form of thick tufts, composed of numerous filaments, united at the base in bundles intermingled together, and fastened to each other by small hooks, with which the stems are furnished. It is seldom employed in this country. The commercial article consists of some 20 or more species, and may be whitish, yellowish, or of a brownish color. It contains bromides, iodides, and other salts, mucilaginous, and gelatinous material. Water dissolves its active principles. It is anthelmintic. The influence exercised by this substance upon the economy is hardly appreciable—perhaps occasionally a slight irritation of the digestive canal—but it acts very powerfully on the *intestinal worms,* especially the lumbricoid. Dr. Johnson affirms that when thrown into the rectum, "it destroys any worms domiciliating there as effectually as choke-damps would destroy the life of a miner." The dose is from 10 to 60 grains, mixed with molasses, jelly, or syrup, or in infusion.

DULSE.—The *Halymenia palmatus,* Agardh, and *Halymenia edulis,* Agardh, of the Atlantic and Mediterranean shores. Iodine, bromine, and mannit were found in these algæ, which appear in commerce as deep-purple mosses, but when growing they have a rich red hue.

GELOSINE.—A substance under this name was proposed as a basis for preparations for topical use (*Brit. Med. Jour.*, Vol II, 1886). It is a dried, mucilaginous preparation, occurring in sheets or leaves nearly white in color, and is the product of a Japanese sea-weed. It dissolves in both water and alcohol, but gradually contracting, expels the water or any foreign substance it may contain.

CHRYSAROBINUM (U. S. P.)—CHRYSAROBIN.

A more or less impure neutral principle extracted from Goa powder, a substance deposited in the wood of *Andira Araroba,* Aguiar (*Nat. Ord.*—Leguminosæ). See also ARAROBA and ACIDUM CHRYSOPHANICUM.

History.—This body is extracted from Goa powder by means of hot benzene. It is largely used in the preparation of chrysophanic acid, which it contains in greater or less quantities, and as a local remedy for parasitic skin diseases. Its composition is mainly $C_{30}H_{26}O_7$. It was differentiated from chrysophanic acid by Liebermann and Seidler, in 1878. This substance, at one time supposed to be chrysophanic acid, is a neutral principle. As a commercial article, it is more or less impure, and is so recognized by the *U. S. P.*, where its use is directed in the preparation of *Unguentum Chrysarobini.*

Description and Tests.—Chrysarobin is a permanent, pale-yellow, or orange-yellow, warty, micro-crystalline powder. It is without taste or odor, but is an irritant to the conjunctival and Schneiderian membranes. It is "very slightly soluble in cold water, or alcohol; soluble, without leaving more than a small residue, in 150 parts of boiling alcohol; also soluble in 33 parts of boiling benzol, and in solutions of the alkalies. When heated to 151° C. (303.8° F.), it fuses, forming a dark, opaque mass; and, when ignited, it is partly sublimed, and finally consumed without leaving a residue"—(*U. S. P.*). It dissolves in sulphuric acid with a yellow color when pure (chrysophanic acid dissolves with red color in this acid). It is somewhat soluble in fusel oil, chloroform, and collodion, but nearly insoluble in ammonia and dilute potassium hydroxide solutions, and yields a brown mass when fused with caustic potash. Chrysophanic acid, on the other hand, dissolves with a red color in dilute solution of the potassium hydroxide; fusion with that agent produces a blue compound. If chrysarobin be dissolved in concentrated solution of caustic potash, a yellow color, accompanied by a marked greenish fluorescence results. In contact with air the solution, by oxidation, turns red and changes to chrysophanic acid. Chrysarobin was named by Attfield, who obtained it by treating Goa powder with boiling benzol. It acquires a deeper tint upon exposure to the atmosphere.

"When boiled with about 2000 parts of water (which produces only partial solution), the light, reddish-brown filtrate does not affect litmus paper, and is not altered by ferric chloride T.S. In concentrated sulphuric acid it is soluble with a deep-red color; on pouring this solution into water, the substance is again deposited unchanged. On adding 0.1 Gm. of chrysarobin to 10 Cc. of potassium or sodium hydrate T.S., in a test-tube, and shaking the latter, the solution, which is at first yellow, or yellowish-red, will gradually acquire a deep-red color"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—The action of this body in certain skin affections is said to be due to its strong reducing powers, its affinity for oxygen being great. It is losing ground as a remedy on account of the occasional recurrence in a more severe form of the maladies that it appears to cure, and also on account of its irritating and staining qualities. *Erythema*, with swelling and cuticular desquamation, with reddening of the conjunctiva, are the effects of its application to the face or scalp. Intensely painful inflammation may succeed, lasting several weeks, and associated with it may be recurrent crops of boils. It has recently been lauded as a remedy for *hemorrhoids*, when combined with belladonna and iodoform in ointment and suppository. Its uses in *skin affections* are precisely those mentioned under araroba and chrysophanic acid (which see). It should not, as formerly, be prescribed under the name *chrysophanic acid*. Taken internally chrysarobin provokes purgation which, though at first delayed, continues for several days without marked discomfort. Doses of about 5 grains (children) and 25 grains (adults) are likely to first cause emesis. If used internally the 1 x or 2 x trituration should be preferred. Locally, the best ointment for general use may be prepared by incorporating 10 to 20 grains of chrysarobin with 1 ounce of lanoline or lard.

Related Products.—ANTHRAROBIN. *Desoxyalizarin* ($C_{14}H_{10}O_3$). *Anthroarobin.*—A reduction product of commercial alizarin, produced by means of nascent hydrogen. A yellowish or yellowish-white powder, readily dissolving in alcohol, cold alkaline solutions, and glycerin; sparingly dissolved by chloroform, ether, and benzol, and practically insoluble in water and acidulous solutions. With fatty bodies it mixes readily to produce ointments. In alkaline solutions it absorbs oxygen from the air, turning to green and blue in color, alizarin being reproduced. When ignited the residue should not amount to more than 2 per cent. It has been used as a substitute for chrysarobinum and pyrogallol, because it is more easily dissolved than the former, and lacks irritant properties. It is weaker in its action than chrysarobin, though its stain is more pronounced upon the skin and linen.

HYDROXYLAMINE HYDROCHLORIDE ($NH_2.OH.HCl$). Hydroxylamine exists free, only in solution. The salt used is the hydrochloride, which forms in hygroscopic, colorless crystals, dissolving in 1 part of water, 1 part of glycerin, and in 15 parts of alcohol. Its solutions are acid in reaction. The salt must be kept in well-closed bottles. It is a strong reducing agent. On account of its non-staining qualities, it has been recommended to replace anthrarobin, chrysarobin and pyrogallic acid in the treatment of skin affections, particularly *scabies, lupus, herpes tonsurans, chronic psoriasis, parasitic sycosis*, etc. A solution (1 to 1000) in glycerin and alcohol (equal parts) is preferred, being applied with a brush to small areas at a time. Stronger solutions do much damage to the skin, and many denounce its use at all, stating it to be inferior to the other applications mentioned and to be liable to serious consequences, both to the skin and to the general system through absorption. Constitutionally it induces a lowered blood pressure and destroys the blood corpuscles, rendering the blood brown in color. It is also destructive to plant life.

CICHORIUM.—CHICORY.

The root of *Cichorium Intybus*, Linné.
Nat. Ord.—Compositæ.
Common Names: *Chicory, Succory, Wild succory.*
Illustration: Johnson's *Med. Bot.*, Fig. 138.

Botanical Source.—Chicory is a perennial plant, having a spindle-shaped, fleshy, whitish, and milky root. The stem is solid, round, furrowed, hispid, very tough, growing 2 or 3 feet high. The radical leaves are spreading, above a span long, numerous, runcinate, toothed, and roughish. The cauline leaves smaller, sessile, less lobed, the uppermost cordate, acuminate, and entire. The flowers are large, 1 or 2 inches in diameter, axillary, in pairs, sessile, placed rather remote on the long, rather naked branches, and of a beautiful bright-blue color. Corollas flat and 5-toothed; involucre roughish; anthers and stigma blue (L.—W.).

History.—Chicory is a native of Europe, but cultivated in this country, where it grows in grass-fields and along roadsides, bearing large, elegant blue flowers in July and August. The root is quite bitter, and imparts its virtues to water. The young leaves are used as a salad. The plant is extensively cultivated for its root, which is used as a substitute for coffee, or for adulterating it; it is dried, roasted, and ground. J. L. Lassaigne states that an infusion of pure coffee acquires a more or less intense green color, when some drops of a solution of persulphate of iron are added to it; while an infusion of chicory retains its brownish color, becoming more intense with a greenish tint. Mr. Horsley proposed bichromate of potassium as a test. It produces no coloration with an infusion of chicory, but gradually changes the weakest infusion of coffee to a deep porter-brown color. When the two infusions are mixed, boil the mixture with the bichromate, add a few grains of sulphate of copper, and again boil. A flocculent precipitate is formed, of a more or less deep sepia-brown color, the intensity of which varies with the quantity of coffee contained. It is sometimes used as an adulterant of dandelion root.

Chemical Composition.—Besides the usual vegetable constituents, this root consists of more than one-third *inulin* ($C_{12}H_{20}O_{10}$), a fine, white, tasteless, and odorless powder, obtained chiefly by expression of the grated roots of various composite plants (see *Inula*). A very pure and pleasantly aromatic alcohol may be obtained from chicory root after the inulin has been converted into sugar by means of the mineral acids. A bitter glucosid, having the formula $C_{32}H_{34}O_{19}$, was obtained in colorless crystals from the flowers by Nietzki, in 1876. Alcohol and hot water dissolve it freely, while it is not soluble in ether. Sugar, pectin, and a bitter principle, not yet isolated, also exist in the root. The leaves yield a bitter body, albuminoids, sugar, and salts.

Action, Medical Uses, and Dosage.—Tonic, diuretic, and laxative. The decoction, used freely, is said to have proved efficient in *jaundice, engorgement of the liver*, and other *chronic visceral diseases*, as well as in *cutaneous eruptions, gout, hectic fever*, etc. An ounce of the root to a pint of water forms a good decoction. It is used as an adulterant of coffee.

Related Species.—*Cichorium Endivia*, Linné. *Garden endive*, a native of the Mediterranean countries, is said, by some French physicians, to be a remedy for *jaundice*. It is also cultivated and eaten as a salad.

CIMICIFUGA (U. S. P.)—CIMICIFUGA.

"The rhizome and roots of *Cimicifuga racemosa* (Linné), Nuttall"—(*U. S. P.*).
Nat. Ord.—Ranunculaceæ.
Common Names: *Black snakeroot, Black cohosh, Rattleroot, Rattleweed, Squawroot.*
Illustration: *Drugs and Med. of N. A.*, by J. U. and C. G. Lloyd, Pl. 21, Vol. I.

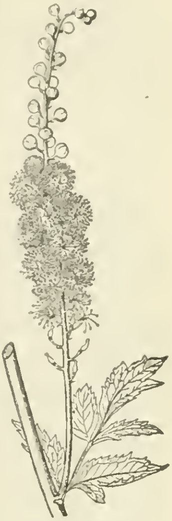
Botanical Source.—This plant is a tall, leafy, perennial herb, having a large, knotty root, with long, slender fibers, and a simple, smooth, furrowed stem, from 3 to 9 feet high. The leaves are large, alternate, and ternately decompound. The leaflets ovate-oblong, incisely serrate, and opposite. The flowers are fetid, small, and borne in long, terminal, slender racemes. The sepals are 4 or 5 in number.

rounded, and white; petals from 4 to 6, small, not so long as the sepals, resembling abortive stamens, and apt to be overlooked. The stamens are very numerous and showy; the anthers introrse and white. The stigma sessile, and lateral; pistils oval, forming dry, dehiscent, ovate, follicular capsules; the seeds numerous, small, and compressed (W.—G.).

History.—The black cohosh is a plentiful and conspicuous plant, growing in fence corners, on side hills and in rich woods. It blooms from the latter part of June until August. It grows from the Indian Territory to the Atlantic coast, extending as far north as the great lakes, and nearly as far south as Florida. The center of distribution is in the Ohio Valley. The part used in medicine is the rhizome, gathered in the autumn and carefully dried in the shade. It has an unpleasant, faint, earthy odor. Boiling water takes up its properties only partially; alcohol or ether wholly. The seeds probably possess active properties. The resin is but little used at the present time except in pill form, in combination with other agents.

Cimicifuga has several common names, as *snakeroot* and *rattleroot*, having been used to cure rattlesnake bites; *rattleweed*, from the fact that the seeds remaining in the pods through a part of the winter, rattle when blown by the winds; *squawroot*, a name more properly belonging to blue cohosh; and its pharmacopœial name, *black snakeroot*. The name *macrotys*, adopted by some Eclectics, is an erroneous one, given by De Candolle, the celebrated French botanist. The proper word is macrotrys, from two Greek words meaning a large bunch, referring to its large raceme of fruit. *Cimicifuga*, its present botanical name, is derived from *cimex* (bedbug), and *fugare* (to drive away), the European species having been used as a bug exterminator. The drug is best known to the members of our school as Macrotys.

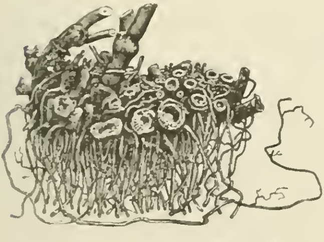
Fig. 71.



Branch of a raceme of Cimicifuga racemosa.

This interesting remedy was a decided favorite with the early Eclectic practitioners, and to this day holds a very prominent place among the remedies originally placed before the medical profession by our school. As early as 1785, Schoepf merely mentioned the plant, but its medical uses were first recorded by Barton, in 1801, who called it squawroot, and writes: "Our Indians set a high value on it." He describes its use in putrid sore throat, itch, and in diseases of women, and further adds that it was used in the treatment of murrain in cattle. Other investigators wrote concerning it from time to time, but to Prof. John King belongs the credit of placing it before the medical profession, and it was through his valuable writings that it became an established and valued remedy. Prof. King began the use of macrotys in 1832, when but few physicians knew anything concerning it as a medicine. In 1835 he prepared the first resin of cimicifuga, often sold under the improper names of *cimicifugin*, *macrotyn*, or *macrotin*. In 1844 he called the attention of physicians to it, and again, in 1846, wrote of it in the *Western Medical Reformer;* though the remedy did not come into general use until about 1850. Finally, when the *Eclectic Dispensatory* appeared in 1852, Dr. King gave the remedy great prominence, and from that time on it has been used very extensively by the Eclectic physicians.

Fig 72.



Fresh rhizome of Cimicifuga racemosa.

Description.—"The rhizome is of horizontal growth, hard, 5 Cm. (2 inches) or more long, about 25 Mm. (1 inch) thick, with numerous stout, upright or curved branches, terminated by a cup-shaped scar, and with numerous, wiry, brittle, obtusely quadrangular roots, about 2 Mm. ($\frac{1}{12}$ inch) thick; the whole brownish-black, of a slight, but heavy odor, and of a bitter, acrid taste. The rhizome and branches have a smooth fracture, with a rather large pith, surrounded by numerous sublinear, whitish wood-rays, and a thin, firm bark. The roots break with a short fracture, have a thick bark, and contain a ligneous cord expanding into about 4 rays"—(*U. S. P.*).

Chemical Composition.—The root yields an impure mixture of resins, to which the names CIMICIFUGIN, MACROTIN, or MACROTYN, have been given. It may be readily prepared by precipitation of the alcoholic extract by the addition of water. Dr. G. W. Mears (*Phila. Monthly Jour. Med. and Surg.*, Sept., 1827) first examined the plant chemically, obtaining therefrom gum, resin, starch, gallic acid, tannin, extractive, and a bitter (acrid) substance, but failed to obtain an alkaloid, for which he searched (*D. & M. of N. A.*, Vol. I, p. 262).

In 1871, Mr. T. Elwood Conrad announced the discovery of a neutral, "crystallizable principle in black snakeroot." By a circuitous process he obtained "a crystalline substance of a light yellow color, not of a very regular or decided shape, but of a massy appearance, resembling almost exactly the crystals of sulphate of aluminum on a small scale." In its behavior and most of its physical properties it resembled the resin. Mr. L. F. Beach (1876) claims to have found the same body in cimicifugin. M. S. Falck (1884) obtained from the fresh juice a body similar to Conrad's, and suspected it to be of an alkaloidal character. Both Profs. F. H. Trimble and J. U. Lloyd, who examined the drug in all conditions, failed to obtain a proximate crystalline substance. The same negative results attended the investigation of Prof. R. R. Warder. Prof. Lloyd believes the product obtained by Conrad to have been merely purified resin—*i. e.*, the resin of cimicifuga (cimicifugin) purified from extraneous substances, and that the gentlemen, who supposed they had obtained a crystalline body, were mistaken as to its structure, or, if they obtained crystals, that they mistook a lead or aluminum salt for a product of cimicifuga. The fresh juice, from which Mr. Falck is said to have obtained crystals, is, according to Prof. Lloyd, composed chiefly of glucose, and has no resin, or but very little of it. According to the latter, the resins are the important constituents of the drug. (See *Drugs and Med. of N. A.*, by J. U. and C. G. Lloyd, Vol. I, p. 262).

Besides the above resinous body, black and green coloring matters, tannic acid, gallic acid, salts of iron, calcium, magnesium, and potassium were found in 1834 by J. H. Tilghman (*Jour. Phil. Col. Pharm.*, VI, p. 20). Mr. G. H. Davis has found the root to contain gum, albumen, extractive, starch, uncrystallizable sugar, tannic acid, gallic acid, resin soluble in alcohol or ether, resin soluble in alcohol and insoluble in ether, fatty matter, waxy matter, volatile oil having the peculiar odor of the root, green and brown coloring matters, lignin and salts of potassium, magnesium, calcium, iron, and silica (*Amer. Jour. Pharm.*, 1861, p. 391). Mr. E. C. Jones found the seeds of cimicifuga to contain gum, starch, fat, tannic acid, gallic acid, a resin soluble in alcohol or ether, a resin insoluble in alcohol, but soluble in ether, and salts of potassium and calcium (*Proc. Amer. Pharm. Assoc.*, 1865, p. 186).

Action, Medical Uses, and Dosage.—This is a very active, powerful, and useful remedy, and appears to fulfil a great number of indications. It possesses an undoubted influence over the nervous system. In small doses the appetite and digestion are improved, and larger amounts augment the secretions of the gastro-intestinal tract. Excretions from the skin and kidneys are increased by it, the peculiar earthy odor of the drug being imparted to the urine; the secretions of the bronchial mucous surfaces are also augmented under its administration. Upon the heart and circulatory system its effects have been compared to those of digitalis, though being much less pronounced. The heart-beat is slowed and given increased power by it, while arterial tension is elevated. In large doses its action on the nervous system is very decided, producing vertigo, impaired vision, dilatation of the pupils, nausea, vomiting, and a reduction of the circulation, but no alarming narcotic effects. Three drops of the saturated tincture given every hour, for 20 hours, have been known to produce symptoms in every way simulating those of delirium tremens. Green tea is said to counteract its narcotic influences.

Upon the reproductive organs it exerts a specific influence, promoting the menstrual discharge, and by its power of increasing contractility of the unstriped fibres of the uterus, it acts as an efficient parturient. The venereal propensity in man is said to be stimulated by cimicifuga.

Few of our remedies have acquired as great a reputation in the treatment of *rheumatism* and *neuralgia*. As early as 1844, in the *New York Philosophical Journal*, Dr. King recommended the use of a saturated tincture of cimicifuga in *acute rheumatism*, stating that the remedy would permanently cure the disease. Prof. King's own statement of his use of it is as follows: "The saturated tincture of this article was recommended by me in acute rheumatism, in the *New York Philosophical Journal*, as early as in the year 1844; to be given in doses of 10 drops every 2 hours, gradually increasing to 60 drops, or until its action on the brain is observed, which action must be kept up for several days; it almost always removes the disease permanently, especially if it is a first attack." The experiences of other physicians since that day give abundant evidence of the truth of his statement. Indeed, few cases of rheumatism, or conditions depending upon a rheumatic basis, will present, which will not be influenced for the better by macrotys. *Rheumatism of the heart, diaphragm, psoas muscles, "lumbago," "stiff neck,"* in fact all cases characterized by that kind of pain known as "rheumatic," dull, tensive, intermittent, as if dependent upon a contracted state of muscular fibre, soreness in muscular tissue, especially over the abdomen and in the extensor and flexor muscles of the extremities, all yield readily to it. If there be febrile and inflammatory conditions it should be associated with specific aconite, or specific veratrum; or possibly specific asclepias will be indicated. If the pain be greatly aggravated by motion, and especially if the serous tissues be involved, specific bryonia should be added to it. Should there be burning pain, aggravated by warmth of the bed, specific rhus. If effusion of serum into cellular structures be present, combine the macrotys with specific apocynum.

In *cardiac rheumatism* it should be given early and in quite full doses, withdrawing the remedy when the full and dull headache is produced by the drug. In this way confirmed rheumatism of that organ may often be averted. It is most useful in acute cases, being of value only to relieve the acute complications that may arise in chronic cardiac rheumatism.

Muscular pain of a rheumatoid character, when not amounting to a true rheumatic attack, and other *rheumatoid pains*, when acute and not of spinal origin, such as *gastralgia, enteralgia, tenesmic vesical pain, pleurodynia, pain in the mediastina, orbits* or *ears*, are relieved by cimicifuga. In *diseases of the ear* the drug is indicated when the condition is aggravated by rheumatic association, or in *neuralgia* of the parts with stiffness in the faucial and pharyngeal muscles. The dose should be about ¼ to ½ drop of specific macrotys every 2 hours. In *eye strain*, giving rise to headache, and associated with a sensation of stiffness in the ocular muscles, or a bruised feeling in the muscles of the frontal region, the same sized doses will give marked benefit. In doses of 1 fluid drachm of the tincture, repeated every hour, it has effected thorough cures of *acute conjunctivitis*, without the aid of any local application. Cimicifuga is a remedy for *dyspeptic manifestations* when due to rheumatoid states of the gastro-intestinal tube, or when associated with rheumatism of other parts of the body. It should be remembered in those cases where there is a dull or aching pain and tendency to metastasis, made worse by taking food or drink, and when the walls of the stomach seem to be contracting upon a hard lump, the patient having a rheumatic tendency or history (Webster).

Macrotys plays a very important part in the therapeutics of gynæcology. It is a remedy for *atony of the reproductive tract*. In the painful conditions incident to imperfect menstruation, its remedial action is fully displayed. By its special affinity for the female reproductive organs, it is an efficient agent for the restoration of *suppressed menses*. It is even a better remedy in that variety of *amenorrhœa* termed "*absentio mensium*." In *dysmenorrhœa* it is surpassed by no other drug, being of greatest utility in irritative and congestive conditions of the uterus and appendages, characterized by tensive, dragging pains, resembling the pains of rheumatism. If the patient be despondent and chilly, combine macrotys with specific pulsatilla, especially in anemic subjects. In the opposite condition associate it with gelsemium. It is a good remedy for the reflex "*side-aches*" of the unmarried woman; also for *mastitis* and *mastodynia*. It should be remembered in *rheumatism of the uterus*, and in *uterine leucorrhœa*, with a flabby condition of the viscus, its effects are decided. When there is a disordered action or lack of functional power in the uterus, giving rise to *sterility*, cimicifuga often corrects the impaired condition and cures. *Reflex mammary pains* during gestation are met by it, and in rheumatic subjects it promptly relieves such ovarian troubles as *ovarialgia* and *neuralgia*, the pain being of an aching character. *Orchialgia* and *aching sensations of the prostate* are conditions calling for macrotys, and as a tonic it is not without good effects in *spermatorrhœa*.

Macrotys has proved a better agent in obstetrical practice than ergot. It produces natural intermittent uterine contractions, whereas ergot produces constant contractions, thereby endangering the life of the child, or rupture of the uterus. Where the pains are inefficient, feeble, or irregular, macrotys will stimulate to normal action. It is an excellent "*partus præparator*" if given for several weeks before confinement. It is a diagnostic agent to differentiate between *spurious* and *true labor pains*, the latter being increased, while the former are dissipated under its use. It is the best and safest agent known for the relief of *after-pains*, and is effectual in allaying the general excitement of the nervous system after *labor*.

Macrotys exerts a powerful influence over the nervous system, and has long been favorably known as a remedy for *chorea*. It may be used alone or with specific valerian, equal parts. It is particularly useful here when associated with amenorrhœa, or when the menstrual function fails to act for the first time. Its action is slow, but its effects are permanent. It has been used successfully as an antispasmodic in *hysteria*, *epilepsy* when due to menstrual failures, *asthma* and kindred affections, *periodical convulsions*, *nervous excitability*, *pertussis*, *delirium tremens*, and many other *spasmodic affections*.

For *headache*, whether congestive or from cold, *neuralgia*, *dysmenorrhœa*, or from *la grippe*, it is promptly curative. As a palliative agent in *phthisis pulmonalis*, good results are obtained, in that it lessens *cough*, soothes the pain, especially the "aching" under the scapulæ, lessens secretions and allays nervous irritability. *Fevers*, *intermittent* and *remittent*, have been benefited by it, well-marked antiperiodic and tonic virtues having been observed in the drug. For *rheumatic fever* we have no better agent, when combined with aconite or veratrum. In the cerebral complications of the *simple* and *eruptive fevers*, especially in children, its action is prompt and decisive. It uniformly lessens the force and frequency of the pulse, soothes pain, allays irritability, and lessens the disposition to cerebral irritation and congestion. In febrile diseases especially, it frequently produces diaphoresis and diuresis. In the *exanthemata*, it is a valuable agent, controlling pain, especially the terrible "bone aches" of *smallpox*, rendering the disease much milder. In *scarlatina* and *measles*, it relieves the headache and the backache preceding the eruptions. It is stated that it has been used in the South with some success as a prophylactic against *variola*. Cimicifuga exerts a tonic influence over both the serous and mucous tissues of the system, and will be found a superior remedy in the majority of chronic diseases of these parts. In all cases where acidity of the stomach is present, this should first be removed, or some mild alkaline preparation be administered in conjunction with the remedy, before any beneficial change will ensue. As a remedy for pain, macrotys is a very prompt agent, often relieving in a few hours, painful conditions that have existed for a long time.

The saturated tincture of the root is recommended as a valuable embrocation in all cases where a stimulant, tonic, anodyne, and alterative combined is required, as—in all cases of *inflammation of the nerves*, *tic-douloureux*, *periodic cephalic pain*, *inflammation of the spine*, *ovarian inflammation*, *spasms of the broad ligaments*, *rheumatism*, *crick in the back* or *side*, *inflammation of the eyes*, *old ulcers*, etc. If a more active preparation is desired, add tincture of grains of paradise in proper quantity, and if a more powerful anodyne be needed add tincture of sulphate of morphine. The specific macrotys will be preferable to the saturated tincture. The local use of the drug, however, is not extensive.

Cimicifugin, whose action differs somewhat from macrotys, was used by Prof. King in the treatment of "*chronic ovaritis*, *endometritis*, *amenorrhœa*, *dysmenorrhœa*, *menorrhagia*, *frigidity*, *sterility*, *threatened abortion*, *uterine subinvolution*, and to relieve severe *after-pains*."

Preparations of cimicifuga, to be of any medicinal value, must be prepared from recently dried roots. In *phthisis pulmonalis*, *cough*, *acute rheumatism*, *neuralgia*, *scrofula*, *phlegmasia dolens*, *amenorrhœa*, *dysmenorrhœa*, *leucorrhœa*, and other *uterine affections*, the alcoholic preparations, as the saturated tincture or the specific macrotys are the best modes of exhibition, and exert a therapeutic influence not to be obtained from the impure resin, termed cimicifugin.

As a *partus accelerator*, it may be substituted for, and should be preferred to, ergot; ½ drachm of the powdered root may be given in warm water every 15 or 20 minutes, until the expulsive action of the uterus is induced, and which it seldom fails to bring on speedily and powerfully. The powder, however, is seldom now used, the specific macrotys in from 15 drops to ½ fluid drachm being given in the same manner. In acute troubles, as *acute muscular rheumatism*, and in *false pains*, and as an oxytocic, Webster prefers the strong decoction of the recent root in tablespoonful doses. The fluid extract of black cohosh may be used in all cases where the article is indicated; its dose is from ½ fluid drachm to 2 fluid drachms. The ordinary dose of macrotys for its specific effects is a teaspoonful of a mixture of from 10 drops to 1 drachm of specific macrotys in 4 ounces of water, the larger or smaller dose being determined by the condition of the patient.

Specific Indications and Uses.—Dr. Scudder gives as the specific indications for this drug: "Muscular pains; uterine pains, with tenderness; false pains; irregular pains, rheumatism of the uterus; dysmenorrhœa. As an antirheumatic, when the pulse is open, the pain paroxysmal, the skin not dry and constricted."

To these may be added a sense of soreness, with dragging pains in the hips and loins; rheumatoid muscular pain; rheumatoid dyspepsia; chorea, associated with "*absentio mensium*."

CINCHONA (U. S. P.)—CINCHONA

The bark of several species of *Cinchona*.

Nat. Ord.—Rubiaceæ.

Common Names: *Peruvian bark*, *Cinchona bark*.

Official Cinchonas. I. Cinchona (*U. S. P.*), *Cinchona*.

"The bark of *Cinchona Calisaya*, Weddell; *Cinchona officinalis*, Linné; and of hybrids of these and of other species of *Cinchona* (*Nat. Ord.*—Rubiaceæ), yielding, when assayed by the process given below, not less than 5 per cent of total alkaloids, and at least 2.5 per cent of quinine ($C_{20}H_{24}N_2O_2+H_2O=341.3$)"—(*U. S. P.*).

(1) *Cinchona Calisaya*, Weddell, furnishes the Cinchona Flava (*U. S. P.*, 1880)—the *Yellow cinchona*, or *Calisaya bark*—(*Cinchonæ flavæ cortex; Cortex chinæ calisayæ, China regia; Cortex chinæ regiæ*).

(2) *Cinchona officinalis*, Linné, furnishes Cinchona Pallida (*U. S. P.*, 1880)—*Pale Peruvian bark*, *Crown bark*, *Loxa bark*—(*Cinchonæ pallidæ cortex; China fusca; Cortex china fuscus; China pallida; China cinerea; China grisea*).

II. Cinchona Rubra (*U.S.P.*), *Red cinchona*, *Red Peruvian bark*, *Red bark* (*China rubra*, *Cortex chinæ ruber*). "The bark of *Cinchona succirubra*, Pavon (*Nat. Ord.*—Rubiaceæ), containing not less than 5 per cent of its peculiar alkaloids"—(*U.S.P.*).

Illustrations: (1) Cinchona Calisaya, Weddell, *Histoire Naturelle des Quinquinas*, Pl. 3, 28; Bentley and Trimen, *Med. Plants*, 141; Flückiger, *Cinchona Barks* (*C. Calisaya* var. *Ledgeriana*, Pl. 3, 4).

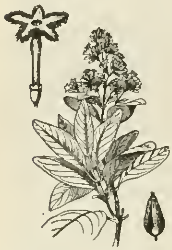
(2) Cinchona officinalis.—Bentley and Trimen, *Med. Plants*, 140.

(3) Cinchona succirubra.—Flückiger, *Cinchona Barks*, Pl. 1; Bentley and Trimen, *Med. Plants*, 142.

Botanical History and Source.—The tribe Cinchoneæ, of the natural order *Rubiaceæ*, includes the genera *Cinchona*, *Cascarilla* (with *Buena* and *Cosmibuena*), *Remijia*, *Macrocnemum*, *Ladenbergia*, and about 30 other nearly allied genera (see *Pharmacographia*). This tribe is comprised of those opposite-leaved shrubs or trees bearing a 2-celled, many-seeded, dry, capsular fruit, and having scale-like, deciduous stipules. The inflorescence is expanded or branched, and not capitate or contracted. The numerous seeds are small and bordered all around by a broad membraneous wing, lacerated or toothed at the edge. The subtribe *Eucinchoneæ* has valvate corollas in contradistinction to the subtribe *Hillieæ*, which has the corolla contorted, inflexed, or imbricated.

The genus Cinchona is finally distinguished by its having the corolla-tube somewhat lengthened and cylindrical, and but slightly contracted or expanded. The lobes of the corolla are 5 in number, small, delicate, expanded flatly, and fringed at the edges. Their color ranges from whitish and purple to bright red or violaceous in the different species. These fragrant flowers are abundant and clustered in cymose or paniculate order. The valves of the capsule dehisce from the base, from the splitting of the partition, the two divisions remaining attached to each other at the apex by means of the permanent 5-toothed calyx. The cinchona trees, or shrubs, are handsome, and have somewhat the appearance of the syringa bush. The leaves, which are of various shapes, from ovate or obovate to nearly circular, sometimes cordate, and, in some species, lanceolate, have always an entire margin (sometimes slightly revolute), and are of variable size and character, often on the same shrub. They are coriaceous, shining, laurel-like, finely-veined, and have a strong midrib. In some of the valuable species, in the vein-axils, near the midrib on the lower surface of the leaf, are small depressions, termed *scrobiculi*, which give out an astringent fluid. Hairy tufts replace these in some species. Often the young leaves are purplish, violet-colored underneath, and the mature leaves before falling assume rich tints of orange or crimson, this being marked in the *C. purpurascens*, Weddell. The petiole is thick, about $\frac{1}{6}$, or less the length of the leaf, and frequently of a handsome red hue. The most valued cinchona trees range from 40 to 80 feet high. They easily form hybrids, of which there are several, and so uniform are the characters of the members of the genus that it is extremely difficult to separate the individual species, which are so closely connected by intermediate forms which tend to form a somewhat connected series.

Fig. 73.



Cinchona Calisaya.

From the foregoing it will be seen that botanical classification has been difficult. The species number about 31. Weddell, whose views are generally accepted, enumerates 33 species and 18 subspecies, with varieties and subvarieties. Bentham and Hooker place the number at 36, De Candolle at 18 species, while Howard indicates 38. On the other hand, O. Kuntze (1882–3) contends for only 4 primary species, with their hybrids; a view, however, not universally accepted, and one based upon observation from cultivated Indian plants and herbarium specimens. The four species of Kuntze are: 1. Cinchona Weddelliana. 2. Cinchona Pahudiana. 3. Cinchona Howardiana. 4. Cinchona Pavoniana.

This agrees but little with the classification of Weddell, who condensed all of his species and subspecies of Cinchona into *stems* (*stirpes* or *souches*). To these fundamental groups, from which all the others radiate, he has placed the best known or most characteristic at the head of each. These *stirpes* or *stems* are: 1. Stirps Cinchonæ officinalis. 2. Stirps Cinchonæ rugosæ. 3. Stirps Cinchonæ micranthæ. 4. Stirps Cinchonæ Calisayæ. 5. Stirps Cinchonæ ovatæ. A comparative table will show the relation of Kuntze's classification to that of Weddell:

WEDDELL'S FORMS OF	ARE DECLARED BY KUNTZE
1. *C. officinalis*	Hybrids of *C. Weddelliana* with *C. Howardiana* and *C. Pavoniana.*
2. *C. rugosæ*	*C. Pahudiana* and hybrids.
3. *C. micranthæ*	*C. Pavoniana* and hybrids.
4. *C. Calisaya*	*C. Weddelliana* and hybrids.
5. *C. ovatæ*	*C. Howardiana.*

Kuntze's classification includes altogether 44 species and hybrids. Probably the most correct estimate of the number of species is that of Baillon, who places it at 20. The following conspectus, extracted by permission from the *Pharmacographia*, gives not only the *stirpes* of Weddell, but the species enumerated in each group, with source, where illustrated, and the barks known or believed to be derived from them:

Species (excluding subspecies and varieties) according to Weddell.	Where figured.	Native country.	Where cultivated.	Product.
I. Stirps Cinchonæ officinalis.				
1. *Cinchona officinalis*, Hook.	Bot. Mag., 5364.	Ecuador (Loxa).	India, Ceylon, Java.	Loxa or Crown bark, Pale bark.
2. *Cinchona macrocalyx*, Pav.	Howard, N. Q.	Peru.	...	Ashy Crown bark. Subspecies, *C. Palton*, affords an important sort called *Palton bark*, used in making quinine.
3. *Cinchona lucumæfolia*, Pav.	do	Ecuador, Peru.		
4. *Cinchona lanceolata*, R. et P. (?)	do	Peru.	...	Carthagena bark, confounded with Palton bark, not so good.
5. *Cinchona lancifolia*, Mutis.	Karsten, tab. 11, 12.	New Granada.	India.	Columbian bark. Imported for manufacture of quinine. Soft Columbian bark is produced by Howard's var. *oblonga*.
6. *Cinchona amygdalifolia*, Wedd.	Wedd., tab. 6.	Peru, Bolivia.	...	A poor bark, but not now imported.
II. Stirps Cinchonæ rugosæ.				
7. *Cinchona pitayensis*, Wedd.	Karst., tab. 22, (*C. Trianæ*).	New Granada (Popayan).	India.	Pitayo bark: very valuable; used by makers of quinine; it is the chief source of quinidine.
8. *Cinchona rugosa*, Pav.	Howard, N. Q.	Peru.	...	Bark unknown; probably valueless.
9. *Cinchona Mutisii*, Lamb.	do	Ecuador.	...	Bark not in commerce; contains only aricine.
10. *Cinchona hirsuta*, R. et P.	Wedd., tab. 21.	Peru.		
11. *Cinchona carabayensis*, Wedd.	Wedd., tab. 19.	Peru, Bolivia.	...	Bark not collected.
12. *Cinchona Pahudiana*, How.	Howard, N. Q.	Peru.	India, Java.	Poor bark; handsome appearance; propagation discontinued.
13. *Cinchona asperifolia*, Wedd.	Wedd., tab. 20.	Bolivia.	...	Bark not collected.
14. *Cinchona umbellulifera*, Pav.	Howard, N. Q.	Peru.	...	Bark not known as a distinct sort.
15. *Cinchona glandulifera*, R. et P.	do	Peru.	...	do do
16. *Cinchona Humboldtiana*, Lamb.	do	Peru.	...	False Loxa bark, Jaen bark. A very bad bark.
III. Stirps Cinchonæ micranthæ.				
17. *Cinchona australis*, Wedd.	Wedd., tab. 8.	South Bolivia.	...	An inferior bark mixed with Calisaya.
18. *Cinchona scrobiculata*, H. et B.	do	Peru.	...	Bark formerly known as *Red Cusco bark*, or *Santa Ana bark*.
19. *Cinchona peruviana*, How.	Howard, N. Q.	Peru.	India	Grey bark, Huanuco, or Lima bark. Chiefly consumed on the continent.
20. *Cinchona nitida*, R. et P.	do	Peru.	India	
21. *Cinchona micrantha*, R. et P.	do	Peru.	India	
IV. Stirps Cinchonæ Calisayæ.				
22. *Cinchona Calisaya*, Wedd.	Wedd., tab. 9.	Peru, Bolivia.	India, Java, Ceylon, Jam'ca, Mex	Calisaya bark, Bolivian bark, Yellow bark. The tree exists under many varieties; bark also very variable.
23. *Cinchona elliptica*, Wedd.	...	Peru (Carabaya).	...	Carabaya bark. Bark scarcely now imported. *C. euneura*, Miq. (flowers and fruit unknown) may, perhaps, be this species.
V. Stirps Cinchonæ ovatæ.				
24. *Cinchona purpurea*, R. et P.	Howard, N. Q.	Peru (Huamalies).	...	Huamalies bark; not now imported.
25. *Cinchona rufinervis*, Pav.	do	Peru, Bolivia.	...	Bark; a kind of a light Calisaya.
26. *Cinchona succirubra*, Pav.	do	Ecuador.	India, Ceylon, Java, Jamaica,	Red bark; largely cultivated in British India.
27. *Cinchona ovata*, R. et P.	do	Peru, Bolivia.	India (?), Java (?).	Inferior brown and grey barks.
28. *Cinchona cordifolia*, Mutis.	Karsten, tab. 8.	New Granada, Peru.	...	Columbian bark (in part). Tree exists under many varieties; bark of some used in the manufacture of quinine.
29. *Cinchona tucujensis*, Karst.	Karsten, tab. 9.	Venezuela.	...	Maricaibo bark.
30. *Cinchona pubescens*, Vahl.	Wedd., tab. 16.	Ecuador, Peru, Bolivia.	...	Arica bark (Cusco bark from var. *Pelletieriana*). Some of the varieties contain aricine. *C. caloptera*, Miq., is probably a variety of this species.
31. *Cinchona purpurascens*, Wedd.	Wedd., tab. 18.	Bolivia.	...	Bark unknown in commerce.

Cinchona Calisaya.—Weddell. This is a high tree, and if we accept the view of Weddell, also exists in a shrub form as var. *Josephiana*. Some botanists, however, regard the latter as distinct, or rather as belonging to no particular species. *Cinchona Calisaya* has an important variety largely cultivated in Java, known as the *Cinchona C.* var. *Ledgeriana* (named from Charles Ledger, who introduced it in Java), which is extremely rich in alkaloids. *C. Calisaya* is distinguished by its smooth, ovate capsules, scarcely equal in length to the flowers. *C. Boliviana*, Weddell, a variety of Bolivia, has leaves with a purplish under surface. (For description of *C. Calisaya* see *Amer. Disp.*, 15th ed.).

Cinchona Calisaya grows in declivities and steep and rugged places of the mountains, at an altitude of from 1500 to 1800 meters in the hottest forests of the valleys of Bolivia and Southern Peru; between 13° and 16° 30′ south latitude, and from 68° to 72° west longitude; in the Bolivian provinces of Enquisivi, Yungas, Larecaja, and Caupolicon; and in the Peruvian province of Carabaya. It flowers in April and May. It yields the *Yellow cinchona bark*, commonly called indiscriminately by the Spaniards and Indians, *cascarilla calisaya*, *calisaya*, or *calisaya*.

Cinchona officinalis, Linné.—This species has suffered much at the hands of botanists, some contending that the name indicating the Linnéan species is capable of double interpretation (Flückiger). Hooker has made a new diagnosis regarded as differing from that of Linné, and the former's plant is now regarded by many as the true *Cinchona officinalis*. Others regard the diagnosis of Linné as correct. This was the original species of Cinchona. It has ribbed capsules. (For a description of this species, see *Amer. Disp.*, 15th ed.). It is indigenous to Ecuador and Peru, and is the source of *Loxa bark*. The Loxa region, however, according to Wellcome, is now exhausted.

Cinchona succirubra, Pavon, is a tall tree, from 50 to 80 feet high, indigenous to the western slope of Chimborazo, its territory of growth extending to northern Peru. It flourishes well in Ceylon, and the Blue Hills of India, being well adapted for grafting and hybridization. Its capsules are smooth. It is the source of *Red cinchona bark*.

History.—As a therapeutical agent of inestimable value, cinchona, from its first introduction and use to the present day, stands pre-eminent. In fact, no article of the Materia Medica has borne so high and unwavering a reputation. It is an agent for which, notwithstanding the vast addition to the list of the Materia Medica, no other substance has been discovered in nature nor in the laboratory that could fully substitute its therapeutical value.

The period of the discovery of the medicinal properties of cinchona, is unknown. Some fabulous stories are mentioned concerning it, but we have no reliable information as to when, or how it was discovered. Some writers (Geoffroy, Ruiz, and Joseph de Jussieu), are of the opinion that the Indians were acquainted with its medicinal properties prior to the arrival of the Spaniards; but even this is doubtful, for La Condamine, who visited Peru in 1738, found the natives then unacquainted with it; and J. J. Caldas, pupil of the celebrated botanist, Mutis, who traveled from 1802 for many years in the mountains of Peru in order to examine the natural history and geographical distribution of the Cinchonas, states that the Indians who inhabit those regions, and among whom fever often makes sad inroads, will not use it, believing that it heats the blood and humors; and states that the heaviest chastisements are often inflicted to compel them to employ it as a remedy; he remarks that this prejudice is much against the fact of their ever having been acquainted with its use, as they cling with the greatest obstinacy to their inherited customs, vices, and prejudices. Ulloa, and Humboldt also express the opinion that the Indians were unacquainted with the use of cinchona.

The introduction of cinchona into Europe dates from the year 1639; it came to be known, it is said, from its having cured the lady of the Comte de Chinchon, at that time Viceroy of Peru, of a fever, and who, upon her return to Spain, carried some of the bark with her. For some time after its introduction, the Jesuits, who received the bark from their brethren in Peru, alone used it, and kept to themselves the secret of its origin; and it was through their use of it that its fame as a febrifuge so rapidly spread, and from which fact it derived the name which still clings to it, of "*Jesuits' bark*." The medical profession at first opposed its use, and it is recorded that it was not employed by them, until Sturm, of Antwerp, in 1659, and Bado, of Genoa, in 1663, advocated its employment and wrote in praise of its virtues. Notwithstanding the length of time that has elapsed since the discovery of the medicinal properties of cinchona bark, its botanical history is yet subject to discussion. A number of botanists have explored and described some of the sources of the barks of commerce, yet much remains to be accomplished The barks that are recognized as official by the Pharmacopœias, both of this country and Europe, are now chiefly cultivated. Much of the information we have concerning them is from the labors of M. Weddell, who accompanied a scientific expedition, under the patronage of the French government, to Brazil and Peru in 1843, and who continued his researches until 1848, since which others have written descriptions, as M. Guibourt, E. Rampon, A. Delondre, G. Planchon, etc. but they have not materially differed from Weddell. Prior to him was Condamine, who first described the Cinchonas, Jussieu, Mutis, Ruiz, Pavon, Humboldt, and Bonpland. Weddell's researches (modified) having been adopted by many as authority, we shall, in the following text, give in a somewhat condensed form his manner of collecting the bark (see *Distribution and Collection*), and some remarks upon the classification of barks into red, yellow, and pale barks, as adopted generally in works upon Materia Medica.

Previous to the year 1775, Loxa bark (most probably derived from Cinchona officinalis), was the only kind of cinchona known in commerce. It was not until 1772 that Mutis discovered the valuable tree in the neighborhood of Santa Fé de Bogota, and at this period Europe began to receive Cinchonas direct from the ports of New Granada, on the Atlantic. Some years later the authors of *Flora Peruviana* (Ruiz and Pavon), studied the species of lower Peru, to the north of Lima, and these were also introduced into commerce. The only species then, which, botanically speaking, still remained unknown in Europe, were those growing in the vast extent of country extending southward. Notwithstanding the efforts of De Jussieu and the botanist, Thaddeus Haenke, little was added to the scientific knowledge of the Cinchonas by their travels. In the work by M. Weddell, he has made known the species observed by him in those regions during the years 1845, '46, and '47. From his observations, this Cinchona (Calisaya) does not spring up again in the localities from which it has been cut, the circumstances peculiar to its growth being, as it were, altered, and a stunted growth, the variety *Josephiana*, is the only representative of the majestic *C. Calisaya* to be found in the localities which have been destroyed by the hands of the cascarilleros in a very ruinous and wasteful manner. To remedy the evil, at least as far as lay in its power, the government of Bolivia prohibited the cutting of the bark from the year 1851 for three years; this, together with a monopoly by the government of all the bark then cut in its territory, caused a rapid rise in the value of calisaya bark, and forced the manufacturers of quinine to use other barks in its preparation.

The immense commercial demands on the Cinchonas of these parts, tending to exhaust the forests, also rendered it necessary that new sources should be discovered. According to Wellcome's report (Flückiger, 1884), the forests of Loxa, for example, are now exhausted of their cinchona trees. To give some idea of the consumption of this bark, and the enormous drain upon the localities from which it was obtained, the company which had a monopoly of it exported at one time annually, more than 850,000 pounds of it. The great extent of the country, however, over which the Cinchonas are spread, excludes the idea, which has been entertained, that we shall ever be deprived of this valuable drug, and the extensive Eastern cultivation now makes the contingency of its extinction next to impossible.

Cultivation.—The subject of cultivation of the Cinchonas early received the attention of botanists and laymen, both with a view to increasing the supply in their native country and their introduction into foreign climes. Condamine made an unsuccessful attempt to transport to Europe young trees, which, in transportation, were lost in the Amazon river. Mutis cultivated the tree, and the Bolivian Jesuits obligated the collectors to plant 5 trees in cross-form on the spots where each tree was felled. The same body of religionists from Peru, made unsuccessful attempts, in 1849, to grow the trees in Algeria. Later, however, several persons, chiefly among whom were Miquel, Pahud (Governor-general of Dutch East

Indics), Hasskarl, Weddell, Karsten, Royle, Markham, and Ledger, succeeded after innumerable and partly vain attempts, in establishing the plants, first in Java and afterward in India. It was with the greatest of difficulty and danger owing to the hostile attitude of the native population, that the plants, or seeds even, could be procured, and the transportation was attended with mishaps, either due to the perishing of the plants or seeds en route, or at stations, or to losses in the sea. The seeds sent by Weddell to Paris were planted in the gardens of Thibaut and Keteleer, and the plants grown therefrom were, in 1852, bought by the Dutch government and sent to Java. The results, however, were none too satisfactory, and it was not until Markham, already well acquainted with the territory, in 1859 went to South America to procure plants, that the foreign introduction of cinchona became at all successful. Upon reaching the cinchona lands he associated with him Spruce, a botanist, Prichett, a resident, and Cross (1861), a gardener, the latter planting with his own hand, in India, the plants procured by him in America. The plants secured by the latter were those of *C. succirubra.* Markham's purpose was to reserve for himself the Peru and Bolivia border-lands, and procure the *C. Calisaya*, of which he collected 456 young plants, amid great dangers and hardships, a graphic account of which is to be found in Markham's work on Peruvian Bark. These plants, which were shipped by way of England, however, in transportation from thence to Hindustan, became exposed to such intense heat while in the waters of the Red Sea, that they were of little value when planted. The deficiency was made up, however, by seeds of *C. Calisaya*, procured from Java, and the cultivation of the Cinchonas in India, Ceylon, and Java, became at last a marked success. The plants obtained by Prichett were from the Huanuco country, and were chiefly plants of *C. nitida* and *C. micrantha.*

The cultivation of the plants in their new homes is not without some drawbacks. According to F. B. Power, the Javan volcanic eruptions of 1883 did great damage to the cinchona plantations. In addition to such accidental injuries, a constant source of trouble is the beetles and caterpillars, as well as a new and small hemiptera, the "*tea bug*" (*Helopeltis Antonii*, Sigm.), the wingless young of which, hatched among the tops of the branches and leafstalks, nourish themselves at the expense of the leaves, producing a disease known as *kinarœst* (see *Cinchona Barks*, Flückiger, Tr. by Power).

The Cinchonas have been cultivated with some success at Jamaica, but the only commercially important ground in South America where cultivation is at all successful is in Bolivia. Western Africa and Mexico have also attempted the cultivation, the former with considerable success. Within a few years the estimated number of cultivated trees was about 75,540,000, Java alone possessing 30,000,000; Central America and Bolivia, each 2,000,000; India, 18,500,000; Ceylon, 19,000,000; Australia, Borneo, and other islands, 1,000,000; Africa, 2,500,000; Jamaica, 500,000, and Mexico the remainder. Only cultivated barks now appear in commerce, the wild bark being seldom met.

Distribution and Collection.—The native Cinchonas seem to be exclusively confined to the Andes within the boundaries of Peru, Bolivia, Ecuador, and New Granada, from 11° north latitude to 20° south latitude; chiefly growing at an elevation varying from 1200 to 10,000 feet above the level of the sea, and in a dry, rocky soil. There are at least 12 or 13 species, which have from time to time furnished the barks of commerce.

The only period in which these cinchona barks are collected, is during the rainy season, which continues some 3 or 4 months. The trees rarely constitute an entire forest, but form more or less compact groups in various parts of the forests, termed *manchas.* Frequently they grow separately. Experienced cutters, called *diestros* or *practicos*, are engaged to explore the forests, and report where the Cinchona trees are to be found, their number, and the quality of the bark they yield. This investigation requires much sagacity, patience, and experience, as the chances of success depend wholly upon the report made. So well skilled are these *diestros* that they can in most instances distinguish the trees by the appearance of their tops, by a peculiar slight movement of the leaves of certain species, by a particular color of the foliage, by the aspect presented by a great mass of inflorescence, etc. Sometimes they are favored with success in a short time, while at other times, many days pass before they can reach the object which they have constantly kept in sight from the moment of its discovery. Matters having been satisfactorily ascertained, the merchant or company desiring to procure the bark, engage other parties who are called *cascarilleros*, and are trained to this occupation from infancy, to cut the bark for them. A road is at once made up to the point which is to form the center of operations, and the *cascarilleros*, together with a confidential agent of the company, called the *majordomo*, construct small huts or houses in a favorable site near this point, both for the purpose of encampment and to shelter their provisions and cuttings. And while the party are engaged in this neighborhood, all parts of the forest adjacent to the roads are considered the property of those who formed it, and no other *cascarilleros* are allowed to work there. The trees are felled with hatchets, being cut a little above the root, the bark having been previously removed from this part, even removing the earth from around the trunk that the barking may be more complete. As soon as all obstacles to the falling of the tree have been overcome, and it lies upon the ground, the useless branches are cut off, and the peridermis is removed by striking it with a wooden mallet, or the back of a hatchet, which exposes the inner bark; frequently this is further cleaned by means of a brush.

The bark is then divided by incisions circumscribing the pieces to be removed, the size and regularity depending upon circumstances, but generally for convenience of transport and facility of preparation they are made from 15 to 18 inches long, and 4 or 5 inches wide. These pieces are removed from the trees, with a common knife or similar instrument, and as close to the wood as possible. The bark of the branches is similarly removed, except that its peridermis is not beaten off. The thinnest bark from the branches is dried by exposure to the sun's rays, and forms hollow cylinders; but the pieces of thicker bark, which are to form the flat cinchona, *tabla* or *plancha*, are, after a slight exposure to the sun, placed one on the other in crossed squares, upon the top of which a heavy weight is placed. This exposure and pressure is repeated for several days until the bark is flattened and completely dried. This is the process more commonly adopted, yet it will sometimes vary a little, according to the locality, or the nature of the tree operated upon. Thus, the peridermis may be simply scraped, or be only partially removed; the bark may be imperfectly or not at all pressed; or it may be imperfectly desiccated, thereby destroying its value, etc. The bark prepared, is carried by the *cascarilleros* in heavy shoulder loads to the camp, which is an inconceivably laborious task, frequently requiring 15 or 20 days for its removal from one district alone. It may be proper to state here, that, as a rule, before the bark reaches the coast, it passes through at least three or four hands, and on each occasion its price is augmented; its carriage from the coast being expensive, and having to pass through other hands also, a pound of the bark that would cost at the coast a certain price, is sold in Europe for the price many times doubled.

As the bark is brought into camp by the cutters, it is examined by the *majordomo*, who, after rejecting that part of it which is bad, submits it, if necessary, to a fresh process of drying. It is then formed into bundles of nearly equal weight, sewn up in coarse canvas, and conveyed on the backs of men, donkeys, or mules, to the depots in the towns, where they usually receive an exterior envelope of fresh hide, which, as it dries, forms the hard compact packages in which the bark is exported, termed *seroons*. Such is the history of the original method as pursued in South America.

The East Indian and Java methods are three: *Mossing*, *felling* or *coppicing*, and *shaving*. The first method, proposed by Karsten and put into operation by W. G. MacIvor, consists of removing from the stems narrow vertical strips of the bark. The denuded surface is then enveloped with moss (clay is now being used in India and Alang-Alang grass in Java) when the bark is quickly renewed, and becomes richer in alkaloidal principles. The second method (*coppicing*) consists in felling the trees and stripping them of bark, while the stumps so left send up shoots, which, in about 8 years, yields a rich bark also. This method is employed in Bolivia to some extent; when the roots are utilized also the process is called *uprooting*. The third method, introduced in Java by Bernelot Moens (1880), is that of *shaving* or *scraping*, which consists in removing not the whole of the bark, but a few layers, leaving enough of it to preserve the vitality of the tree. The effect of these methods has been a greatly increased yield of alkaloids.

Classification of Barks.—In most works on Materia Medica, we find the cinchona barks classified according to their color, *i. e.*, into the *yellow*, *pale* and *red barks;* the *Cinchona Calisaya*, as yellow bark; the *C. officinalis*, and others, as pale barks; and the *C. succirubra*, as red bark. This classification, while convenient, is very defective; not only does it, in some instances, separate the products of the same tree, but it connects those which are essentially different. At one time it was thought that all the gray cinchonas were furnished by the same species, but not only are they produced by many different species, but very frequently they are the young bark of the same trees which yield the yellow and red cinchonas. A more useful and, indeed, more natural classification would be founded, in the first instance, upon the chemical composition of the barks, it being only necessary to study their active principles, as quinine, cinchonine, etc. But this method is impracticable on account of the unavoidable difficulties arising from such a mode of classification, and, also, from the fact now fully proved, that the same botanical species furnish barks varying greatly, according to accidental circumstances. Weddell remarks that if a classification be absolutely needed, one which should be based upon the anatomical structure of the bark would be of much greater utility than either of the preceding, inasmuch as we shall find existing, even in the cinchonas, a certain relation between their structural and chemical characters. M. Weddell gives the data upon which he bases the latter conclusion which, however, can not be here discussed. The classification of commercial cinchona barks, according to their color, has been most generally accepted. At the present day such a classification is even more easily made than in earlier days, for the various sources and conditions of the bark caused the colors to vary greatly, and even to merge closely into one another. The color was chiefly based upon the powder rather than upon the exterior of the bark. The botanical sources of the three grades are now, however, well known on account of their being cultivated. To those species, with their hybrids, which have become official, may be added mention of an inferior bark now known as *hard yellow*, or *Maracaibo bark*. These distinctions into red, yellow, etc., are mainly taken cognizance of by pharmacists, the manufacturers of alkaloids caring but little for classification, their reliance being placed upon all barks which, by assay, will yield them the greatest amount and best quality of bases. A convenient classification is that less in vogue known as *druggists' barks* (quills, or large chips), and *manufacturers' barks* (broken bark). In general, barks occur in commerce in 5 chief forms: (1) small chips or fragments, which includes much of the broken bark and pieces of root bark; (2) shaved bark, which includes largely barks of branches and dry stems, with some root bark; (3) irregular flat chips or pieces of varying sizes and shapes, mostly made up of hard yellow bark; (4) the cultivated, together with some wild bark, in the form of quills, taken from stem and root; (5) and lastly, the thick, mossed bark and thinner renewed bark, obtained by the mossing process. Making allowances for different conditions existing at the time of gathering, such as the age of the plant, etc., the following descriptions will apply to the barks as classified according to color:

Description of Barks.—YELLOW BARK (*Calisaya bark*, *Cinchona flava*), from *C. Calisaya* and its variety *Ledgeriana*. Mostly cultivated, rarely collected wild, in great demand, and greatest quinine yielder (70 to 80 per cent of whole yield of alkaloids). The best bark; the *quill* forms only commercial, the *flat*, or *table bark*, being rarely met at present (see below). Large, handsome quills, sometimes broken, varying from 18 to 30 inches long, and from ⅛ to ¼ inch thick, and occasionally 2½ inches wide; color gray, or light-brown gray externally, pale cinnamon-brown internally, the inner surface marked with very fine striæ. Its powder is a pale, yellow-brown. The *quilled bark* may be in fragments varying from 1 or 2 inches to 24 inches in length, from 2 lines to 2 inches in diameter, and from ½ to 7 lines in thickness. Very small quills, however, are very rare. They are generally singly quilled, though occasionally met with doubly quilled. Usually *coated*, with an outer bark or periderm; sometimes *uncoated*, or deprived of its periderm; the inner, living part of the bark, Weddell terms its *derm*, in contradistinction to its external covering, or *periderm*.

In the *coated* specimens, the periderm varies in thickness, is more or less rugous, and marked with transverse impressions, furrows, or cracks, which sometimes form complete rings around the quills. The edges are thick, everted, and raised. If the periderm is very thick, the consistence of it is corky or elastic, and the annular furrows have the appearance of deep incisions. Between these annular markings are longitudinal wrinkles or cracks. In the large quills, these furrows and cracks give the bark a very rough character (the so-called carved, or chicken-legged appearance), by which it may easily be distinguished from the large quills of gray bark (*Huanuco*). The periderm is nearly tasteless, having a naturally brown color, but sometimes more or less gray or silvery from the crustaceous lichens with which it is covered.

The flat, or *uncoated* bark, consists chiefly of liber; its taste is very bitter and feebly astringent; its transverse fracture, externally, is resinous, internally fibrous. The color is brown externally, and it is marked with impressions corresponding to the furrows or cracks of the periderm. Internally, it is finely fibrous, and of a deep cinnamon-brown color.

Pale Bark (*Loxa bark, Loja bark, Crown bark, Huanuco bark, Cuenca bark*). From *Cinchona officinalis*. Cultivated largely in India, and collected wild in Ecuador in former times, chiefly around Loxa. Large quinine yielder (60 to 70 per cent of whole yield of alkaloids). Entire or broken (irregularly), single or double quills 3 to 15 inches long, by ¼ to ¾ or 1 inch in diameter, chiefly 1 or 2 lines in thickness, but very variable in this respect. Its periderm is darker than in other species, and its powder light-brown. More lichens are present upon it than upon other barks, rendering it shaggy, and sometimes a portion of the ridges are verrucose. Its fissures are broader and more open than in the preceding bark, nor does it contain but a few longitudinal cracks, and is therefore not "checkered or chicken-legged" in appearance. The upper surface of the bark is very variable. According to age, temperature, and locality, it varies from a *light-brownish* color to *black*. If the trunk and branches are much exposed to the sun and wind, the bark becomes black, and if the tree is closely surrounded by other trees, it assumes a brownish color, which varies to a light-yellowish gray. A large quantity of lichens grow on the whole of the surface. On the epidermis, whatever its color may be, annular impressions or furrows are always perceptible, although sometimes but slightly impressed. They are the traces of places where the stipules were situated. Immediately beneath each ring are two almost circular cicatrices, formed by the petiole after the fall of the leaves. Between the rings many other transverse furrows and cracks, varying in length, depth, and distance from each other, are perceived, mostly parallel to the rings, but never extending entirely around the trunk. All these characteristics of the surface are also found on other species of *Cinchona*, and are therefore insufficient of themselves to distinguish any species. On the inner smooth surface, which is formed of fine, parallel, longitudinal fibers, we perceive numerous whitish spots, some of which are shining, but most of them dull. The color of this surface is similar to that of dry cinnamon, passing rather into yellow when the bark is fresh. The edges of the fractured surface of the bark are sharp, like grass, and only here and there a small point is perceptible on the inner edge. Under a magnifier the epidermis appears attached (*gebunden*), blackish, and shining; the subjacent parenchyma, which forms a concentric ring, is thicker than the epidermis, sometimes blackish, sometimes brownish-yellow with many shining spots. Next follow the layers formed of parallel fibers, between which we observe shining points, which proceed from the gummy, resinous juice diffused through the entire bark. This is the only official species which has an odor, which, in this bark is distinct and characteristic. J. J. Caldas, writing in 1802, states: "The natives call it *cascarilla fina amarilla* and never quina. It flowers very probably twice, in July and August, and in December and January. The leaves fall successively, as is the case with most equinoctial plants. By the epithet *amarilla fina* it is distinguished from *colorada fina*, which differs from the typical principal form by the color of the fresh bark, which is reddish, whereas the other is yellow. This quality, however, does not appear to be permanent, for when the amarilla is dried it assumes the color of the other sort, so that the most experienced person is unable to distinguish (by color alone) one from the other."

Red Bark (*Cinchona rubra*).—From *C. succirubra*. Chiefly cultivated, except in South America. Yields an abundance of alkaloids, but of quinine only about

2 per cent. Quills thicker and wider than calisaya, otherwise quite similar, and the inner surface of a much redder cinnamon-brown than that species. Yields a reddish-brown powder. Transverse fissures few or none; when present disposed irregularly not forming a checkered or chicken-legged appearance. The prominent suberous, warty ridges, often short and merging into each other, and the elongated furrows between the ridges are distinguishing features (see *Official Description*).

The hybrid barks vary somewhat from these descriptions. *Cinchona rubra* is very largely hybridized with *C. officinalis* and vice versa, and with *C. Calisaya* and its variety *Ledgeriana*. The hybrids with the former are lighter in color, and show the transverse fissures. The hybrids of the latter species with *C. succirubra* yield a bark in which the characteristics of the latter are most prominent (For the other known barks and their sources, see *Conspectus*, already given). The *U. S. P.* has combined the medicinal cinchonas into two classes, made official as follows:

I. CINCHONA (*U. S. P.*).—"In quills or incurved pieces, varying in length and usually 2 or 3 Mm. ($\frac{1}{12}$ or $\frac{1}{8}$ inch), or sometimes 5 Mm. ($\frac{1}{5}$ inch) thick; the outer surface covered with a gray or brownish-gray cork, usually slightly wrinkled, marked with transverse, and also with intersecting, longitudinal fissures (*C. Calisaya*), and sometimes with scattered warts and slight longitudinal ridges; inner surface light cinnamon-brown, very finely striate; fracture short and granular in the outer layer, and finely fibrous in the inner layer; powder light-brown or yellowish-brown; odor slight, somewhat aromatic; taste bitter and somewhat astringent"—(*U. S. P.*).

II. CINCHONA RUBRA (*U. S. P.*) *Red cinchona.*—"In quills or incurved pieces, varying in length, and from 2 to 4 or 5 Mm. ($\frac{1}{12}$ to $\frac{1}{6}$ or $\frac{1}{5}$ inch) thick; the outer surface covered with grayish-brown cork, more or less rough from warts and longitudinal warty ridges, and from few, mostly short, transverse fissures; inner surface more or less deep-reddish-brown and distinctly striate; fracture short-fibrous in the inner layer; powder reddish-brown; odor slight; taste bitter and astringent"—(*U. S. P.*).

The *Maracaibo* or *Hard yellow bark* (*Puerto Cabella bark*), of uncertain derivation, is a wild bark yielding very little quinine, and unimportant so far as its consumption in this country is concerned. It may be employed for the extraction of alkaloids other than quinine, is very bitter, and is used in some countries in the preparation of *Huxham's Tincture.*

Chemical Composition.—I. GENERAL CHEMICAL HISTORY. The very earliest chemical examinations of Peruvian bark were directed to the determination of amounts of resinous and extractive bodies, and the action of menstrua upon it. However, very early attempts were made to separate a febrifuge principle, but without success. The first alkaloidal principle isolated from cinchona was *cinchonine*, the existence of which had been pointed out, in 1803, by Dr. Duncan, of Edinburgh; it was first isolated and obtained in a state of purity by Gomez, a physician of Lisbon. He attributed the efficacy of cinchona barks to the presence of this body; but he failed to recognize its alkaline character, which, indeed, was not fully appreciated till after the discovery of morphine was announced by Sertürner, in 1816, when an impetus was given to investigations for alkaloids. Toward the year 1820, Pelletier and Caventou pronounced the alkaloidal character of cinchonine, an observation which was communicated to them by Houton-Labillardière; at the same time these chemists made the important discovery of *quinine.* About twelve years later two other French chemists, MM. Henry and Delondre, discovered in yellow cinchona bark a third alkaloid to which they gave the name of *quinidine.* In 1829, Sertürner, already celebrated by his discovery of morphine, observed in the mother-liquors of sulphate of quinine an uncrystallizable base, which he called quinoidine, and to which he attributed wonderful febrifuge properties. This last substance *quinoidine* (or more properly *chinoidin*), was undoubtedly a distinct amorphous base, but the name was shortly afterward applied to a deep-brown, brittle mass obtained by precipitating the mother-liquors from quinine works with ammonia, the substance so obtained being a mixture of alkaloids, subsequently found to be chiefly *dicinchonine* ($C_{38}H_{44}N_4O_2$), and *diconchinine* ($C_{40}H_{46}N_4O_3$). Quinoidine was formerly used in medicine under the name *amorphous quinine.* Resinous matter, as well as the *amorphous* and artificial constituents, were contained in it (see *Chinoidinum*). In 1847 Winckler obtained a new alkaloid from Maracaibo bark, to which he gave the name *quinidine*. Pasteur, however, in 1853, proved this to be different from the quinidine already known, and affixed to it the name *cinchonidine*. A number of alkaloids have since been isolated from the various species of cinchona (see below).

The discovery of alkaloidal principles in cinchona is antedated by the isolation of a peculiar and comparatively inert acid by Fr. Chr. Hofmann, in 1790, who gave it the name *Chinasäure* (*kinic acid*). A (calcium) salt of this acid was first observed in a sediment from an extract of cinchona, by Count de Laragaye, as early as 1745. Another discovery of early date is that of *chinovin* (*quinovin* or *kinovin*), by Pelletier and Caventou, in 1821, who named it *acide quinovique*, having obtained it from the bark of Cinchona nova surinamensis. It is a non-crystallizable, bitter principle which was later ascertained to be a glucosid (see below).

As a matter of history we retain the following results of some of the early investigators: Bucholz found in cinchona bark (Loxa), cinchonine 0.36, kinic acid 1.17, kinate of calcium 1.30, hard resin (red cinchonic) 9.97, bitter soft resin 1.56, fatty matter with chlorophyll 0.78, tannin with some chloride of calcium (?) 5.80, gum 4.43, starch a trace, lignin 74.43. According to M M. Pelletier and Caventou, the pale, yellow and red barks contain kinate of quinine, kinate of cinchonine, soluble cinchona-red, or cincho-tannic acid, insoluble cinchona-red, yellow coloring matter, grass-green coloring matter, kinate of calcium, starch, gum, and lignose.

II. THE CINCHONA ALKALOIDS.—More than 40 alkaloids, both natural and artificial, have been derived from cinchona, cuprea, and related barks. Of these, those existing in greatest amount and of medicinal value, are but 4, viz.: *Quinine*, *quinidine* (Hesse's *conquinine*), *cinchonine*, and *cinchonidine* (*quinidine*); two others of importance are *quinamine* and *conquinamine* (*conchinamine*). Of these the first two are isomeric, and the third and fourth are likewise isomeric, comprising two main groups of cinchona alkaloids, one or more of the alkaloids of which are found in the cinchona barks.

The following tabulated statement indicates the numerous alkaloids with their composition and some points of interest connected therewith:

Alkaloids.	Composition.	Discoverer.	Source.
1. QUININE	$C_{20}H_{24}N_2O_2$	Pelletier and Caventou, 1820.	
2. QUINIDINE (Hesse's *Conchinine*).	$C_{20}H_{24}N_2O_2$	Henry and Delondre, 1833.	
3. CINCHONINE.	$C_{19}H_{22}N_2O$	Gomez, 1812; Pelletier and Caventou, 1820.	
4. CINCHONIDINE.	$C_{19}H_{22}N_2O$	F. L. Winckler, 1847.	Maracaibo bark.
5. QUINAMINE.	$C_{19}H_{24}N_2O_2$	Hesse, 1872.	*Cinchona succirubra* and *Crosulenta.*
6. CONQUINAMINE (*Quinamidine*) (Hesse's *Conchinamine*).	$C_{19}H_{24}N_2O_2$	Hesse, 1877.	
7. HOMOQUININE (*Ultraquinine*).	$C_{19}H_{22}N_2O_2$	Tod, Howard, Hodgkin, Paul, Cownley and Whiffen, 1882.	*Cinchona cuprea.*
8. CUPREINE.	$C_{19}H_{22}N_2O_2$	Paul and Cownley.	*Cinchona cuprea.*
9. HYDROQUININE.	$C_{20}H_{26}N_2O_2$	Hesse.	
10. HYDROQUINIDINE.	$C_{20}H_{26}N_2O_2$	Forst and Boehringer	Derived from quinidine.
11. HYDROCINCHONINE.	$C_{19}H_{24}N_2O$	Caventou.	Derived from cinchonine. Exists in Cuprea bark (Hesse).
12. HYDROCINCHONIDINE (*Cinchamidine*).	$C_{19}H_{24}N_2O$	Hesse, 1881.	
13. CINCHONAMINE.	$C_{19}H_{24}N_2O$	Arnaud, 1881.	*Remijia Purdieana.*
14. CINCHOTINE.	$C_{19}H_{24}N_2O$	Hesse, 1882.	
15. HOMOCINCHONINE.	$C_{19}H_{22}N_2O$	....	*Cinchona rosulenta.*
16. HOMOCINCHONIDINE.	$C_{19}H_{22}N_2O$	Hesse, 1877.	*Cinchona rosulenta.*
17. CUSCONINE.	$C_{23}H_{28}N_2O_4$	Hesse, 1877 (Leverköhn, 1829 [?]).	Cusco and Cuprea barks.
18. CUSCONIDINE.	$C_{23}H_{28}N_2O_4$	Hesse, 1877.	

Alkaloids.	Composition.	Discoverer.	Source.
19. CONCUSCONINE.	$C_{23}H_{26}N_2O_4$	Hesse, 1883.	Cuprea bark.
20. CONCUSCONIDINE.	$C_{23}H_{26}N_2O_4$	Hesse, 1883.	Cuprea bark.
21. CUSCAMINE.	Not analyzed.	Hesse, 1880.	Cusco bark.
22. PAYTINE.	$C_{21}H_{24}N_2O+H_2O$	Hesse, 1870.	Payta, or White Cinchona bark.
23. PAYTAMINE.	$C_{21}H_{24}N_2O$		
24. PARICINE.	$C_{16}H_{18}N_2O$	Winckler, 1845.	Para bark.
25. DICINCHONINE.	$C_{38}H_{44}N_4O_2$		
26. ARICINE (Manzini's *Cinchovatine*).	$C_{23}H_{28}N_2O_4$	Pelletier and Cariol, 1829.	Cusco and Cuprea barks.
27. DIQUINIDINE (Hesse's *Dicinchonine*).	$C_{40}H_{46}N_4O_3$		
28. CHAIRAMINE.	$C_{22}H_{26}N_2O_4$	Hesse, 1885.	*Remijia Purdieana.*
29. CHAIRAMIDINE.	$C_{22}H_{26}N_2O_4$	Hesse.	
30. CONCHAIRAMINE.	$C_{22}H_{26}N_2O_4$	Hesse.	
31. CONCHAIRAMIDINE.	$C_{22}H_{26}N_2O_4$	Hesse.	
32. CUSCAMIDINE.	Not analyzed.	Hesse, 1880.	Cusco bark.
33. JAVANINE.	Not analyzed.	Hesse, 1877.	*Cinchona Calisaya* var. *Javanica.*
34. DIHOMOCINCHONINE.	$C_{38}H_{44}N_4O_2$	....	*Cinchona rosulenta.*
35. CINCHOLINE.	Not analyzed.	Hesse, 1882.	Quinine mother-liquors.
DERIVATIVES.			
36. CINCHONICINE.	$C_{19}H_{22}N_2O$	....	Derived from cinchonine and cinchonidine.
37. DICINCHONICINE.	$C_{38}H_{44}N_4O$	....	Derived from cinchonine and cinchonidine.
38. HOMOCINCHONICINE.	$C_{19}H_{22}N_2O$	....	Derived from homocinchonidine sulphate.
39. APOQUINAMINE.	$C_{19}H_{22}N_2O$	....	Derived from quinamine, or conquinamine.
40. QUINICINE.	$C_{20}H_{24}N_2O_2$	....	Derived from quinine and quinidine.
41. DIQUINICINE.	$C_{40}H_{46}N_4O_3$	....	Derived from quinine and quinidine.
42. QUINAMICINE.	$C_{19}H_{24}N_2O_2$	....	Derived from quinamine sulphate.
43. PROTOQUINAMICINE.	$C_{17}H_{20}N_2O_2$	Hesse.	Derived from quinamine sulphate.

The first 35 alkaloids in the preceding table are regarded as naturally existing in cinchona, cuprea and related barks; the first 4 only are employed medicinally; the last eight are the artificially produced alkaloidal bases. According to Flückiger (*Cinchona Barks*, p. 64), "every cinchona bark contains amorphous alkaloids." The majority, however, are crystallizable.

Of the cinchona alkaloids, four are considered elsewhere under their respective heads, or as sulphates. These are *Quinine*, *Quinidine*, *Cinchonine*, and *Cinchonidine*. The others will be briefly considered here.

QUINAMINE ($C_{19}H_{24}N_2O_2$) (*Quinamia* or *Chinamine*).—Long, white, asbestos-like, nearly tasteless crystals; dextrogyre; anhydrous; its solution in diluted sulphuric acid is not fluorescent. Somewhat soluble in boiling water, nearly insoluble in cold water, soluble in ether, benzol, and benzin, most readily when hot, depositing crystals on cooling and evaporating; hot alcohol dissolves it, depositing crystals on cooling, the solution being alkaline; soluble in caustic potash solution and in ammonia. With hydrochloric and sulphuric acids it forms salts, their solutions being very bitter. Gold chloride precipitates solutions of the hydrochlorate yellowish-white, changing to purple, while gold is liberated; the solution at the same time turns purple-red. Boiled with diluted sulphuric acid it changes to isomeric noncrystallizable *quinamidine*, behaving similarly to quinamine with gold chloride; quinamine sulphate heated to the boiling point of water changes to *quinamicine*, also isomeric. The sulphate heated to 120° C. (248° F.), or higher, forms *protoquinamicine*. *Apoquinamine* is produced when *quinamine* or *quinamicine* is treated with hydrochloric acid, resulting in the abstraction of water. Quinamine fuses at 172° C. (341.8° F.).

Apoquinamine ($C_{19}H_{22}N_2O$).—Foliaceous, white, easily soluble in ether, diluted hydrochloric acid and alcohol. Its gold chloride double salt does not change to purple. Its amorphous hydrochlorate dissolves readily in water. Apoquinamine is isomeric with *homocinchonidine*, *homocinchonine*, and *homocinchonicine*. It is an artificial base.

Homoquinine ($C_{19}H_{22}N_2O_2$) (*Ultraquinine* of Whiffen). Obtainable from cuprea bark. Crystalline, soluble freely in chloroform and alcohol, but sparingly in ether, from which solvent it may be crystallized. Diluted sulphuric acid dissolves it, the solution giving the thalleioquin reaction (see *Quininæ*). It is extremely levogyrate, and fuses at 177° C. (350.6° F.). Its sulphate, like that of quinine, forms a fluorescent solution in water; the salt when freshly prepared, is soluble in ether (difference from quinine sulphate). The cold saturated solution of the sulphate in water is precipitated by Rochelle salt, thus behaving like quinidine and cinchonidine (*Amer. Jour. Pharm.*, 1882, p. 75).

Cinchonamine ($C_{19}H_{24}N_2O$).—Associated with cinchonine. A dextrogyrate base, discovered by Arnaud, in 1881, in the bark of *Remijia Purdieana*, and said to have sialagogue properties, and to be much more toxic than quinine. Readily soluble in hot alcohol, less so in cold alcohol (1 in 30), and in ether (1 in 100). It fuses at 184° to 185° C. (363.2° to 365° F.) (Arnaud). It is usually extracted from the bark with milk of lime, the magma dried, boiled with alcohol, treated with hydrochloric acid, and crystallized as hydrochlorate. Water and diluted alcohol sparingly dissolve its crystalline salts, the sulphate being an exception.

Cinchotine ($C_{19}H_{24}N_2O$) is obtained by oxidizing crude cinchonine sulphate with potassium permanganate in the cold, which leaves cinchotine unaffected. It agrees with Willms' and Caventou's *hydrocinchonine*, which see.

Hydroquinidine ($C_{20}H_{26}N_2O_2.2\frac{1}{2}H_2O$), (*Hydroconchinine*), forms efflorescing crystals soluble freely in chloroform and hot alcohol, but less so in ether. It is dextrogyrate, gives the thalleioquin reaction, is fluorescent in sulphuric acid solution, and fuses at 168° C. (334.4° F.) (Hesse). It is present, according to Forst and Boehringer (1882), in commercial quinidine, from which it is obtained by oxidation with potassium permanganate in acid solution.

Hydrocinchonine ($C_{19}H_{24}N_2O$).—Obtained by the action of sodium amalgam upon cinchonine acetate in alcoholic solution. Soluble in ether, alcohol, and water (1 in 1300).

Hydrocinchonidine ($C_{19}H_{24}N_2O$).—This base is found in commercial cinchonidine together with homocinchonidine.

Cupreine ($C_{19}H_{22}N_2O_2$). Isomeric with homoquinine. Crystallizes from ether with 2 molecules of H_2O; from alcohol, anhydrous. Soluble readily in alcohol; sparingly in chloroform or ether. Solutions alkaline, give thalleioquin coloration, and are levogyrate; the alcoholic solution strikes red-brown with chloride of iron. It forms a crystallizable sodium compound ($C_{19}H_{21}N_2O.ONa$), which is mainly of theoretical interest.

Hydroquinine ($C_{20}H_{26}N_2O_3.H_2O$) occurs in the mother-liquors from the manufacture of quinine sulphate; it has been found present in commercial quinine sulphate to the extent of 4 per cent (Hesse). According to Allen's method, purification of quinine from hydroquinine is effected by allowing the quinine to crystallize as acid sulphate, whereby hydroquinine remains in solution. Ether and alcohol dissolve it, it exhibits the thalleioquin reaction, is fluorescent in sulsulphuric acid solution, and fuses at 168° C. (334.4° F.). Potassium permanganate does not affect it when cold.

Homocinchonine ($C_{19}H_{22}N_2O$) (Koch's *Cinchonidine*).—This body has been confounded with *cinchovatine* (*aricine*). From alcohol it forms large prismatic crystals, having a left-handed rotation. Salts partly amorphous.

Dihomocinchonine ($C_{38}H_{44}N_4O_2$), is amorphous, and exhibits a right-handed rotation with polarized light.

Homocinchonidine ($C_{19}H_{22}N_2O$) occurs in large prisms, and is said to form the chief part of the *cinchovatine* (aricine) of Winckler. It is levogyre, its sulphate crystallizes in gelatine-like needles, holding $6H_2O$, and soluble in hot water.

Paytine ($C_{21}H_{24}N_2O.H_2O$), a crystalline body, and Paytamine, from a species of *Aspidosperma* called *Payta* or *White cinchona bark*. The latter is amorphous, and both are levogyrate, and form insoluble double salts with chloride of platinum, thus differing from quinamine which they resemble in solubility in ether and in the instability of the double salts they form with gold chloride.

Paricine ($C_{16}H_{18}N_2O$), a yellowish powder, was isolated by O. Hesse from the bark of *C. succirubra*, of Darjeeling, associated with quinamine and other bases. When fresh, ether will dissolve it, and nitric acid changes it to a deep-green, resinous material. It is separated from its associated alkaloids by means of sodium carbonate, the paricine precipitating first. Paricine closely resembles aricine, but differs in being more soluble in ether, and being uncrystallizable.

Cusconine ($C_{23}H_{26}N_2O_4$). A crystallizable body soluble in chloroform, alcohol, and ether, and scarcely at all in water. It has been believed to be identical with aricine, but differs from most cinchona bases in its salts being gelatinous and not dissolved by sulphuric acid. Its neutral sulphate is yellow, gelatinous, non-crystalline, and insoluble in sulphuric acid in excess. Accompanying it in Cusco bark, besides *aricine*, is Cusconidine, an amorphous, yellow body. Concusconine ($C_{23}H_{26}N_2O_4$) from *Remijia Purdicana* (Hesse), is crystalline and tasteless.

Cuscamine is crystalline, easily soluble in hot alcohol, ether, and chloroform, and insoluble in nitric and oxalic acids. It fuses at 218° C. (424.4° F.).

Cuscamidine is amorphous, and otherwise agrees with the preceding in solubility, etc.

Aricine (Manzini's *Cinchovatine*) ($C_{23}H_{26}N_2O_4$) forms salts which are not readily soluble. This body, as cinchovatine, was found in Arica bark by Pelletier and Coriol in 1829. Aricine crystallizes in white, non-volatile needles, fusible at 187.7° C. (370°F.), insoluble in water, and soluble in ether; forms a characteristic acetate and acid oxalate.

Dicinchonine ($C_{38}H_{44}N_4O_2$) is one of the constituents of commercial chinoidine, the chief other one being Diquinidine (Hesse's *Diconchinine*) ($C_{40}H_{46}N_4O$). It is dextrogyre, fluorescent in solution, and does not give the thalleioquin coloration. Was found by Hesse (see *Amer. Jour. Pharm.*, 1885), especially in the bark of *C. rosulenta*.

Quinamidine ($C_{19}H_{24}N_2O_2$) (*Conquinamine*, *Quinamidia*, or Hesse's *Conchinamine*). Forms long, lustrous, prismatic crystals, fusing at 123° C. (253.4° F.). With gold chloride it behaves like quinamine. It is non-fluorescent, and gives no thalleioquin reaction. It is obtained from the barks of *C. succirubra*, *C. rosulenta*, and other India barks. An amorphous *quinamidine* (isomeric) is produced as stated under *quinamine*. It forms a sparingly soluble hydrochlorate.

Quinamicine ($C_{19}H_{24}N_2O_2$) is amorphous, white, melts at 100° C. (212° F.), and is soluble in acids, from which it may be precipitated by sodium bicarbonate. It is obtained by heating quinamine with diluted acids.

Protoquinamicine ($C_{17}H_{20}N_2O_2$) is a brown amorphous body precipitated from its sulphuric acid solution by sodium carbonate. Ether does not dissolve it. Water scarcely dissolves its sulphate. An artificial product.

Javanine.—Crystallizable, easily dissolved by ether, and forms an intense yellow solution in diluted sulphuric acid. Occurs in *C. Calisaya* var. *Javanica*.

Cincholine.—A pale-yellow, volatile oil, tasteless, yet of alkaline reaction, easily dissolving in ether, chloroform, and alcohol; little soluble in water. This alkaloid has the odor of chinoline.

Cinchonicine ($C_{19}H_{22}N_2O$) is formed when cinchonine or cinchonidine is fused in the presence of acids. It is isomeric with these bodies. It is amorphous, soluble in alcohol, water, and especially in ammonium salts; dextro-rotatory.

Dicinchonicine (*Apodicinchonine*). One of the constituents of commercial chinoidine.

Quinicine ($C_{20}H_{24}N_2O_2$). Amorphous, very soluble in alcohol, little soluble in water, dextrogyrate, its sulphuric acid solution non-fluorescent.

Chairamine ($C_{22}H_{26}N_2O_4.H_2O$). White acicular crystals, soluble in chloroform and ether.

Conchairamine ($C_{22}H_{26}N_2O_4.H_2O.C_2H_6O$). Forms crystals containing both water of crystallization and alcohol of crystallization. Hot alcohol, chloroform, and ether dissolve it. A mixture of sulphuric and molybdic acids dissolves the alcoholate, the solution being first brown, changing to deep-green.

Conchairamidine ($C_{22}H_{26}N_2O_4.H_2O$). White needle-crystals soluble in ether, chloroform, alcohol, benzene, and acetone (O. Hesse, *Amer. Jour. Pharm.*, 1885).

The following table exhibits the more noteworthy properties of the principal cinchona alkaloids, the table being that of Flückiger, in *Cinchona Barks*, p. 66:

(a)	Hydrated crystals are formed by	Quinine, Quinidine.
	Not containing water of crystallization	Cinchonine, Cinchonidine, Quinamine, Homoquinine.
(b)	Abundantly soluble in ether	Quinine, Quinidine, Quinamine.
	Slightly soluble in ether	Cinchonidine, Cinchonamine.
	Very sparingly soluble in ether	Cinchonine.
(c)	Levogyrate solutions afforded by	Quinine, Cinchonidine.
	Dextrogyrate solutions afforded by	Quinidine, Cinchonine, Quinamine.
(d)	Thalleioquin is afforded by	Quinine, Quinidine, Homoquinine.
	Thalleioquin is not afforded by	Cinchonine, Cinchonidine, Quinamine.
(e)	Fluorescence is displayed in the acid solutions of salts of	Quinine, Quinidine, Homoquinine.
	No fluorescence is displayed by	Cinchonine, Cinchonidine, Quinamine.

III. Acid and Other Constituents of Cinchona.—The cinchona alkaloids exist naturally in the bark in combination with one or more acids—*kinic*, *kinovic*, and *cinchotannic acids* being associated with them, forming *kinates* (*quinates*), *kinovates* (*quinovates*), and *cinchotannates*. These acids are minor principles so far as the medicinal value of the cinchonas is concerned.

Kinic Acid (*Quinic*, or *Cinchonic acid*) ($C_7H_{12}O_6$).—This is the *Chinasäure* of Hofmann, and is a principle closely related to quercite or acorn-sugar ($C_6H_7[OH]_5$). It was among the first observed of the cinchona constituents, its calcium compound having been obtained as early as 1745 by the Comte Claude Toussaint Marot de Lagaraye. Hermbstädt (1785), of Berlin, indicated the character of the compound, though he believed the acid to be tartaric, but the acid was identified and named, in 1790, by Friedrich Christian Hofmann, a Hanovarian chemist, of Leer. This body gives to the aqueous extracts of cinchona their acid character, being present in some barks to the extent of 9 per cent. Besides, it occurs in coffee beans, and in several species of *Vaccinium*, *e. g.*, the American cranberry (E. Claassen, 1890). It forms readily soluble, hard, and large monoclinic crystals, permanent in the air. The aqueous solution is without odor, and is purely sour and not bitter to the taste. Such a solution exerts a left-handed polarization. It is more soluble in water than in strong alcohol, but very little soluble in ether. At 162° C. 323.6° F.) the crystals fuse. This acid is a benzol derivative, having the graphic formula $C_6H_7.(OH)_4.COOH.$, which explains the possibility of its being reduced to benzoic ($C_6H_5.COOH$) and protocatechuic acids ($C_6H_3[OH]_2.COOH$) by means of heating with hydriodic acid. By more energetic oxidation, as when treated with sulphuric acid and manganese dioxide, it yields, besides formic acid and carbon dioxide, *kinone* (*quinone*) ($C_6H_4O_2$), a crystalline, bright-yellow sublimate. Its physiological effects are not pronounced.

Kinovic Acid (*Quinovic*, or *Chinovic acid*) ($C_{24}H_{38}O_4$) is obtained from East India barks by extraction with dilute alkalies, precipitation with acid and purification of the precipitate. It was first obtained as a decomposition product of the glucosid *kinovin* (Hlasiwetz). It forms shining, white crystals, or a crystalline powder, not soluble in water or chloroform, sparingly soluble in cold alcohol and ether, more readily soluble in hot alcohol, and easily soluble in the solutions of alkaline carbonates and caustic alkalies. It is a feeble acid, and all its solutions are bitter. It is reputed tonic, a calcium compound seeming to have been preferred for its exhibition. Kinovic acid results from the action of hydrochloric acid upon an alcoholic solution of chinovin, whereby this substance is split into a smeary, uncrystallizable sugar, called *mannitan*, or *kinovic sugar* ($C_6H_{12}O_5$), and *kinovic acid* ($C_{24}H_{38}O_4$).

Cinchotannic Acid (*Cinchotannin*, or *Quinotannic acid*) ($C_{14}H_{16}O_9$).—This is tannic acid, or tannin of cinchona, and the *soluble red coloring matter*, or *soluble cinchona-red* of Pelletier and Caventou. It has all the properties of tannin; it precipitates ferric solutions green (the red from the pale bark, however, precipitates these solutions brown). It also precipitates gelatin and tartar emetic, and forms a compound with starch, insoluble in the cold, but soluble above 50° C. (122° F.). It exists in cinchona barks in amounts varying from 1 to 4 per cent.

De Vrij, in 1885, observed in one sample of Cinchona officinalis, the exceptionally high amount of 12 per cent (*Amer. Jour. Pharm.*).

When prepared from its lead salt it forms an acidulous non-bitter astringent and very hygroscopic mass of a bright yellowish color. It is soluble in water, ether, and alcohol. Heated to 100° C. (212° F.), cinchotannic acid turns dark-red, at the same time becoming insoluble in water. Its aqueous solution absorbs oxygen from the air, particularly if acids or alkalies have been added, and red products are formed. When boiled with diluted sulphuric acid it splits into cinchona-red and sugar (Rembold, 1867).

CINCHONA-RED, or *Insoluble cinchona-red* ($C_{28}H_{22}O_{14}$), is inodorous, insipid, reddish-brown, nearly insoluble in water and ether, readily soluble in alcohol and alkalies, does not precipitate gelatin, but does precipitate tartar emetic. It exists in some specimens of bark to the extent of 10 per cent, being most abundant in the thicker red barks. It is undoubtedly formed in the bark by the decomposition of cinchotannic acid. Fused with caustic potash it yields protocatechuic acid. An ammoniacal solution of cinchona-red yields, with alum, a red lake.

Besides the acid bodies, the following principles belong to this class of barks:

Chinovin (*Quinovin*, or *Kinovin*) ($C_{30}H_{48}O_8$).—This is an amorphous, bitter glucosid, found not only in the cinchonas, but in the nearest relatives among the *Rubiaceæ*, and is the body known as *cinchona-bitter*, *chinova-bitter*, or *kinovic-bitter*. It was first observed by Pelletier and Caventou, in 1821, in *Cinchona nova surinamensis*, and named *quinovic acid* ("*acide quinovique*") a name afterward corrected, and which properly belongs to the acid which has been considered above. Water hardly dissolves chinovin, but it is freely soluble in acetone, alcohol, ether, chloroform, and oils. It has no action upon litmus, yet, with the alkalies, it forms salts, most of which dissolve in water, the solutions being very bitter.

Kerner (1859–62) has applied the name *cinchocerotin* to a substance obtained by extracting cinchona with boiling alcohol, from which solution it separates on cooling. Purified, it displays handsome, pure white, crystalline laminæ, of a neutral reaction, and fusible at 130° C. (266° F.). Its composition corresponds to the formula $C_{27}H_{48}O_2$. Fabbroni first separated the volatile oil, which is of a butyraceous consistence, and gives to cinchona barks their odor.

Tests and Quantitative Determination of Alkaloids in Cinchona Bark.—As stated before, the *U. S. P.* demands that CINCHONA contain not less than 5 per cent of alkaloids, at least 2.5 per cent of which must be quinine. CINCHONA RUBRA is required to contain not less than 5 per cent of its peculiar alkaloids. The table on page 549, compiled mainly from data contained in Flückiger's *Cinchona Barks*, by Power, 1884 (marked in the table by *), demonstrates the amount of alkaloids in various species of cinchona barks.

Broughton found but little more than traces of alkaloid in the *leaves* of the Indian *Cinchona succirubra*. Happersberger (*Amer. Jour. Pharm.*, 1883, p. 197), from analyses of the leaves of several species of *Cinchona*, found those of the *C. Calisaya* to have a predominant amount of bases (2 per cent)—these alkaloids being quinine, quinidine, cinchonine, and cinchonidine, quinidine amounting to about one half of the total yield. These species were grown in an unfavorable locality in California. Therefore the leaves seem to deserve more recognition than has hitherto been given them.

TESTS FOR SPURIOUS BARKS.—As spurious barks, liable to be substituted, are found in commerce, it is of importance that some ready means for their detection should be known. Bitterness is not always characteristic of the value of cinchona bark; barks which do not contain traces of alkaloids, and yet contain considerable kinovic acid, are very bitter. An infusion of such barks will give, upon the addition of a solution of sulphate of copper, a greenish precipitate of kinovate of copper. Tannic acid has been recommended as the best reagent for distinguishing the genuine from the spurious barks, as it forms insoluble compounds (tannates) with the alkaloids of genuine Peruvian barks. In using this test, all that is necessary will be to make a decoction or infusion of the bark under examination, filter it, add a solution of tannic acid, when, should the bark contain any of these peculiar alkaloids, the addition of the solution of tannic acid will immediately cause a precipitate of them as tannates. Consequently those barks which yield no precipitate with tannic acid, are destitute of these alkaloids.

Species.	Investigator.	Source.	Part of plant analyzed.	Remarks.	Quinine.	Total alkaloids.	Date of analysis.
*C. corymbosa.**	Karsten	S. Columbia.	Bark of trunk.	Collected from volcanic Mts., 11,375 feet alt.	None.		
*C. corymbosa.**	Karsten.			Other parts of same district.	0.75 p.ct.		
*C. corymbosa.**	Karsten.			Central elevated regions.	1.25 to 3.5 p.ct. of quinine sulphate.		
*C. lancifolia.**	Karsten.	Bogota.	Bark of branches. Bark of trunk.	Of same mountain ridge.	Traces. 2 to 4 p.ct. quinine sulphate.		
C. pubescens, Vahl.*					None.		1871.
*C. succirubra.**	De Vrij.	Ootacamund.	Bark of *root.*			12 p.ct.	
*C. succirubra.**		India.	Bark.		Often 1, seldom 4, and 3 to 4 p.ct. cinchonidine.	6 to 11 p.ct.	
*C. succirubra.**		Java.			0.4 to 2.5 and 1.3 to 5.2 p.ct. of cinchonidine.	3.2 to 9.8 p.ct.	1881.
C. succirubra.	H. Brandner.			Commercial specimen.		3.5 p.ct.	*A. J. P.*, 1885, p. 600.
C. succirubra.	C. H. McCoy.			Commercial specimen.	1.265 p.ct. (*U.S.P.* method), 2.16 p.ct. (Squibb's method).	5.385 p.ct. (*U.S.P.*) method), 5.58 p.ct. (Squibb's method).	*A. J. P.*, 1887, p. 69.
*C. officinalis.**	De Vrij.	Ootacamund.	Bark.		1.25 to 9 p.ct.		1873.
C. officinalis.	C. H. McCoy.	Neilgherry.		Commercial specimen.	1.93 p.ct. (*U.S.P.* method), 2.24 p.ct. (Squibb's method).	9.79 p.ct. (*U.S.P.* method), 9.82 p.ct. (Squibb's method).	*A. J. P.*, 1887, p. 69.
*C. Calisaya.**	De Vrij.	Java.	Bark of trunk.	7 years old. 6½ years old.		0.64 p.ct. 5 p.ct.	1864. 1864.
C. Calisaya.	C. H. McCoy.			Commercial specimen (quill).	1.35 p.ct. (*U.S.P.* method).	5.275 p.ct. (*U.S.P.* method).	*A. J. P.*, 1887, p. 69.
C. Calisaya.	H. Brandner.			Commercial specimen (quill).		2.572 p.ct.	*A. J. P.*, 1885, p. 600.
C. Calisaya.	H. Brandner.			Commercial specimen (flat).		2.14 p.ct.	*A. J. P.*, 1886, p. 600.
*C. Ledgeriana.**	Bernelot Moens.	Java.		80 analyses.	0.8 to 11.6 p.ct.	1.09 to 12.5 p.ct. (only in 13 cases less than 5 p.ct.)	1879.
*C. Ledgeriana.**	Bernelot Moens.	Java.			2.3 to 8 p.ct.	4.3 to 9 p.ct.	1880.
*C. Ledgeriana.**	Bernelot Moens.	Java.			1.2 to 8.1 p.ct.	2 to 9 p.ct.	1881.
*C. Ledgeriana.**	Bernelot Moens.	Java.				13.61 p.ct.	1882.

Mr. Grahe has also instituted the following ready process for distinguishing the true from the false barks. He finds that true cinchona barks, when submitted to dry distillation, give a product of a bright carmine color; this product is characteristic of these barks, and is not furnished by any others that do not contain the cinchona alkaloids. The quantity of this red substance depends upon the amount of the alkaloids, and it appears to afford a tolerable indication of this amount. This test is applied by heating the fragment of a bark, weighing about 5 or 10 grains, in an ordinary test-tube, gradually raising the heat to redness. With cinchona bark a whitish smoke is given off, and also watery vapor, which condenses upon the sides of the tube. Very shortly afterward, the red color begins to appear, communicating to the vapor a reddish tinge, and at about one inch distant from the heated portion of the tube there is deposited a red pulverulent film, which gradually passes into a thick oleaginous liquid, running down the glass in drops or streaks of a fine carmine color, in the water condensed with it. Close to this point are deposited the tarry products, generally resulting from the destructive distillation of vegetable substances. The presence of some substances prevents the production of this red color, even in the case of the true cinchona barks, such as caustic alkalies, lime, nitric and chromic acids, bichromate of potassium, glacial phosphoric acid, and sulphuric acid.

As regards the quantitative determination of the alkaloids contained in cinchona barks, numerous assay methods have been proposed (see for example that of Dr. J. F. L. Winckler, *American Dispensatory*, 15th edition). These methods have been appropriately classed by Husemann and Hilger (*Pflanzenstoffe*, 1884) into 3 groups, according to the agent employed in the abstraction or liberation of the alkaloids, and are thus distinguished as *Acid methods*, *Lime methods*, and *Ammonia methods*. For an account of De Vrij's process, which is a representative of the acid methods, see *Amer. Jour. Pharm.*, 1885, p. 627. The process of the *British Pharmacopœia*, and that indicated by Squibb (*Ephemeris*, Vol. I, p. 105, 1883), are methods employing lime, while those directed by the *German* and the *United States Pharmacopœias* employ ammonia. For an interesting comparative study of some recent methods, see L. F. Kebler, *Amer. Jour. Pharm.*, 1896, p. 79. The United States Pharmacopœial process is as follows:

Assay of Cinchona.—I. *For Total Alkaloids.*—"Cinchona, in No. 80 (or finer) powder, and completely dried at 100° C. (212° F.), twenty grammes (20 Gm.) [309 grs.], alcohol, ammonia water, chloroform, ether, normal sulphuric acid V.S., potassium hydrate V.S., each a sufficient quantity. To 20 Gm. of cinchona, in very fine powder, and contained in a bottle provided with an accurately ground glass stopper, add 200 Cc. of a previously prepared mixture of 19 volumes of alcohol, 5 volumes of chloroform, and 1 volume of ammonia water, stopper the bottle and shake it thoroughly and frequently during 4 hours. Then separate the liquid by pouring it into another bottle through a funnel containing a pellet of cotton, in such a manner that no material loss by evaporation may result. Transfer 100 Cc. of the clear filtrate (representing 10 Gm. of cinchona) to a beaker, and evaporate it to dryness. Dissolve the residue of crude alkaloids thus obtained in 10 Cc. of water and 4 Cc. of normal sulphuric acid, with the aid of a gentle heat, filter the cooled solution into a separatory funnel, and wash the beaker, and filter until the filtrate no longer has an acid reaction, using as small a quantity of water as possible. Now add 5 Cc. of potassium hydrate V.S., or such an amount as will render the liquid decidedly alkaline, and extract the alkaloids by shaking the mixture, first with 20 Cc., and then repeatedly with 10 Cc. of chloroform, until a drop of the last chloroform extraction, when evaporated on a watch-glass, no longer leaves a residue. Evaporate the united chloroformic extracts in a tared beaker, dry the residue at 100° C. (212° F.), and weigh. The weight found, multiplied by ten (10), will give the percentage of *total alkaloids* in the specimen of cinchona tested.

II. *For Quinine.*—"Transfer 50 Cc. of the clear filtrate remaining over from the preceding process (and representing 5 Gm. of cinchona) to a beaker, evaporate it to dryness, and proceed as directed in the assay for total alkaloids, using, however, only one-half the amounts of volumetric acid and alkali there directed. Add the united chloroformic extracts containing the alkaloids in solution, gradually, and in small portions at a time, to about 5 Gm. of powdered glass contained in a porcelain capsule placed over a water-bath, so that, when the contents of the capsule are dry, all or nearly all of the dry alkaloids shall be in intimate admixture with the powdered glass, and the chloroform be completely expelled. Now moisten the residue with ether, and, having placed a funnel containing a filter of a diameter of 7 Cm., and well wetted with ether, over a small graduated tube (A), transfer to the filter the ether-moistened residue from the capsule. Rinse the latter several times, if necessary, with fresh ether, so as to transfer the whole of the residue to the filter, then percolate with ether added drop by drop, until exactly 10 Cc. of percolate have been obtained. Then collect another volume of 10 Cc., by similar, slow percolation with ether, in a second graduated tube (B). Transfer the contents of the two tubes completely (using ether for washing) to two small, tared capsules, properly marked (A and B) so as to avoid confusion, evaporate to a constant weight at 100° C. (212° F.), and weigh them. (The residue in A will contain practically all the quinine, together with a portion of the alkaloids less soluble in ether; the residue in B will consist almost entirely of these alkaloids). From the amount of residue obtained in capsule A deduct that contained in B, and multiply the remainder by twenty (20). The product will represent, approximately, the percentage of *quinine* (containing 1 molecule of water) in the specimen of cinchona tested"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Cinchona bark is tonic, antiperiodic, slightly astringent, and topically antiseptic. When swallowed, a sensation of warmth is experienced at the stomach, which gradually spreads over the whole trunk; occasionally, it produces an unpleasant excitement of the stomach and bowels, with retching and emesis, more especially if the former be sensitive. In a little while after its administration the general system becomes more or less influenced, the pulse being fuller and more rapid, and a gentle stimulus imparted to the various organs of the body. With many persons it occasions symptoms which have been termed *cinchonism*, and which, some believe, are evidences that the remedy is exerting a favorable influence; but these symptoms should never be pushed too far. They are: Throbbing headache, and giddiness, of greater or less severity, tinnitus aurium, and imperfect hearing. Cinchona is valuable in functional derangement of the stomach, improving digestion, and invigorating the nervous and muscular systems in diseases of general debility, and in convalescence from exhausting diseases. Cinchona will be found useful in all *febrile*, *eruptive*, and *inflammatory diseases*, which manifest a degree of periodicity, in which it should be administered during the remissions; it is also valuable during the low and *typhoid conditions* of these diseases, and also in those cases, where, from an excessive and continued secretion of pus, the system becomes very much enfeebled and prostrated, in which it supports the powers of the constitution until all abnormal action is removed. It is likewise of much benefit in all chronic affections attended with periodicity, great feebleness, or nocturnal perspiration. When it occasions vomiting, its use should be suspended for a time. Its employment is contraindicated in acute inflammation, inflammatory fever, plethora, active hemorrhages, and in all nervous or vascular irritations.

Cinchona bark, however, exhibits its most important therapeutical powers as an antiperiodic, and in the consequent influence it exerts in almost invariably curing *remittent* and *intermittent fevers*, and the generality of diseases which are accompanied by symptoms of marked periodicity, as *neuralgia*, *hemicrania*, *dyspepsia*, *diarrhœa*, and *dysentery*, when epidemic, etc. Its use should in most cases be preceded by a mild laxative, after the action of which the powder may be given in doses of 10 to 60 grains, and repeated, according to circumstances, every 1, 2, or 4 hours, until 1 or 2 ounces have been taken during the periods of intermission, and continue thus until a cure is effected, or the remedy is found insufficient for the cure of the disease. In the use of the barks, to obtain their antiperiodic influence, the red and yellow are considered superior to the pale, and of which the red is preferred. As a tonic, the pale bark is generally preferred, being less obnoxious to the stomach and intestines. Quinine, or its salts (see *Quininæ Sulphas*), especially the sulphate, is usually employed as a tonic and antiperiodic in place of the bark itself, but there have been many instances in which the bark in powder has succeeded in effecting a cure, when its alkaloidal salts failed; the cause of this is not well understood. Still, it is often the case that the crude drug, which holds all associated principles, is more effective than its isolated alkaloids. In such cases, when the powder, from its bulk, or otherwise, offends the stomach, the infusion, decoction, tincture, or extract may be administered. Sometimes cinchona, or its preparations, occasion purging, which may be obviated by small portions of opium or laudanum. When a tonic effect only is desired, and periodicity is lacking, or when a tonic is indicated after *exhaustive bleeding*, the bark is preferable to the quinine salts, and, for some reason not well determined, the bark is sometimes preferable in chronic cases of *ague*. Cinchona is to be preferred when an astringent effect is desired.

Externally, a poultice of the bark has been found an excellent application to *felons, fetid* and *gangrenous ulcers*, etc.; also as an injection with opium, when the stomach rejects it; the powdered bark, placed between muslin, and held in place by sewing it in cross-bars, the same as in quilting, making medicated jackets, to be worn in contact with the body, has been of utility in *obstinate intermittents*. Dose of cinchona as an antiperiodic, from ½ to 1 drachm; as a tonic, from 10 to 60 grains; of the infusion or decoction, 2 fluid ounces, to be repeated 2 or 3 times a day; of the extract, from 5 to 30 grains; of the fluid extract, 10 to 60 drops; of specific cinchona, 5 to 30 drops.

Quinine, cinchonine, and quinidine appear to possess somewhat similar medicinal properties; their salts (as the sulphate) appear to be best adapted for medicinal use, principally on account of their ready solubility. Dose of either, from 1 to 5 grains, 3 times a day, or oftener, if required; in severe *intermittents* as high as 10 grains may be administered for a dose.

Specific Indications and Uses.—Periodicity and, like quinine, effective when the pulse is soft and open, the tongue moist and cleaning, the skin soft and moist, and the nervous system free from irritation. If opposite conditions prevail, cinchona will be likely to aggravate. Empyema; gastric debility; anemia and debility from chronic suppuration; afternoon febrile conditions; weakness, with pale surface, loss of appetite, feeble digestion, and deficient recuperative powers.

Related Barks.—FLAT CALISAYA, scarcely ever met in American markets, occurs in pieces from 8 to 15 inches in length, from 1 to 3 inches broad, and from 1 to 5 lines in thickness. It is but slightly curled, generally uncoated. It has considerable density, is perfectly uniform in texture, marked on its outer surface by longitudinal digital furrows, more or less running into one another, and separated by projecting ridges. Its external surface is of a somewhat brownish tawny-yellow, often with blackish-red patches; its internal surface is fibrous, of a yellowish-tawny color, sometimes—especially when the bark is fresh—with an orange tint, and often with an undulating grain. The transverse fracture is fibrous, the fibers being short, easily detached, and irritating the skin like the hairs of *Dolichos pruriens*. The longitudinal fracture is not splintery, and presents a surface covered with brilliant points, owing to the reflection of light from the denuded fibers, and is of a uniform color. The taste is very bitter, the bitterness being gradually developed by mastication, with scarcely any astringency.

The great reputation of the calisaya bark has made it so much sought after, that it was becoming exceedingly rare, and there is no doubt that it might have one day disappeared almost entirely from commerce, and that we should be obliged, ultimately, to be satisfied with one or other of the species judged of less value. Cultivation has, however, removed the possibility of its extinction. In this connection, *Amer. Jour. Pharm.*, 1896, p. 120, remarks that the species C. Ledgeriana, cultivated in Java, now yields a surplus of quinine. Weddell says that the increasing scarcity of calisaya bark induced the *cascarilleros* constantly to mix the barks of several of their Cinchonas, and this fraud was effected much more successfully than it was formerly, and, without much experience, it was sometimes difficult of detection. The admixture was made especially with the barks of *Cinchona Boliviana* and *Cinchona ovata* var. *rufinervis;* or, more rarely, and only on the coast, with the bark of *C. scrobiculata;* in other words, with the barks which M. Guibourt calls, with much justice, *the light calisayas of commerce*. With the bark of scrobiculata it would not be likely to be long confounded, but it may readily be so with the first two; so much is this the case that in Bolivia the bark of *C. Boliviana* is also called *Calisaya bark*, a name which its properties will, at any rate, justify. The *best characters* by which to distinguish the true (flat) calisaya from all other species, are, the shortness of the fibers which entirely cover the surface of its transverse fracture, and the facility with which these are detached, instead of remaining adherent and pliant, as in the case with the rufinervis and scrobiculata. Lastly, its uniform rufus color, and its not being marbled throughout its thickness with white, sufficiently distinguish it from the bark of *C. Boliviana*. Added to these characters, its great density, the depth of the furrows and the projecting edges, are generally sufficient to distinguish the flat calisaya from all other barks with which it may be mixed. Rolled calisaya is much more difficult to distinguish, for not only does its peridermis, in its physical character, much resemble that of many other species, especially that of scrobiculata and rufinervis, but the fracture does not present clear characters as it does in older barks. If even a microscope be used in the examination, the characters are very slight.

Spurions Cinchona Barks. Previous to the discovery of the alkaloids, various barks entered commerce either as adulterants or substitutes for cinchona barks. Since the alkaloids have become so well known, these false barks, which anatomically differ from the true cinchonas, as well as being very inferior in value, have been designated *spurious cinchona barks.* They seldom now appear in commerce. They were derived chiefly from the generas, *Cascarilla*, *Ladenbergia*, *Exostemma*, and *Nauclea.* The bast fibers of those barks closest related to cinchona exhibit central cavities—the so-called sieve-like fibers. Grahe's test is regarded as sufficient to distinguish most of these barks from the true cinchonas.

Cuprea Bark is the most important of the spurious barks now recognized. It does not enter into general commerce, but is abundantly used in the manufacture of quinine. The name *cuprea* was given it by Flückiger, in 1871, on account of its peculiar rusty copper color. It comes from the central and southern sections of Colombia, along the eastern Andes. The *Remijia Purdieana*, Weddell, and *Remijia pedunculata*, Triana (*Cinchona pedunculata*, Karsten), are pointed out by Triana (1882) as the source of that from the first-named locality. The bulk of these barks comes in small fragments, though some of it occurs in flattish or channelled pieces, and, occasionally, in quills about 20 inches long, and from less to ¼ inch in thickness. The corrugated, or warty, light-brown cork is removed, so that the scraped, smooth surface often shows sharply incised impressions, made with a sharp knife, thus showing the characteristic copper color of the outer bark tissue. It is much harder than the true cinchona, is heavy, and sinks in water. That from south Colombia is more compact, denser, and exhibits a corneous fracture. By Grahe's test it yields the red tar, like the cinchonas. The total alkaloids average about 3 per cent, 2 per cent of which is quinine, cinchonine and quinidine being the remainder. According to Hesse, Howard, and others, cinchonidine is not present. The south Colombian cuprea barks contain cinchonamine.

Fraudulent Red Cinchona Barks are produced by acting upon inferior barks with ammonia, thereby producing cinchona-red. Their red aqueous preparations precipitate brown-red with Nessler's reagent, instead of white, as with good or normal cinchona barks.

Other Cinchona Barks.—A number of unofficial barks have been known from time to time. A number of them are given in the *Conspectus* under Cinchona.

Crossopteryx febrifuga, Bentham (*Nat. Ord.*—Rubiaceæ). Africa. This bark is febrifuge, and yields (Hesse) *crossopterin*, a white, non-crystalline alkaloid soluble in alcohol, ammonia, and ether. A blue fluorescence marks its infusion, which dissappears in the presence of sulphuric acid, and is restored by an alkali, even after the infusion has been boiled.

Pinckneya pubens, Michaux (*Cinchona caroliniana*, Biret).—Yields *Georgia bark*, a febrifuge and tonic. Swamps from South Carolina to Florida. *Cinchonine* (?) is said by Farr to be present in the bark.

Other Febrifuges.—China Morada, *Quina morada.* The bark of *Pogonopus febrifugus* (*Nat. Ord.*—Rubiaceæ), and several other Bolivian and Argentine Republic trees. The former contains a fluorescent (blue) body, *moradin*, and an alkaloid, *moradeine.* Therapy, the same as Cinchona.

Panbotano Bark.—Root of *Calliandra Houstoni* (Leguminosæ). Mexico. A tincture of 2 ounces of the root taken in 4 doses in a day, is highly praised as an antiperiodic (Valude).

Garrya Fremonti, *California fever-bush*, *Skunk-bush.*—The intensely bitter leaves of this California shrub are provincially used as an antiperiodic and tonic. The alkaloid, *garryine*, was announced by D. W. Ross (*Amer. Jour. Pharm.*, 1877). Dose of fluid extract, 10 to 30 drops.

CINCHONIDINÆ SULPHAS (U. S. P.)—CINCHONIDINE SULPHATE.

Formula: $(C_{19}H_{22}N_2O)_2H_2SO_4+3H_2O$. Molecular Weight: 738.52.

"The neutral sulphate of an alkaloid obtained from the bark of various species of Cinchona"—(*U. S. P.*).

History and Preparation.—The base, *cinchonidine*, is contained chiefly in the cultivated India species, *Cinchona officinalis*, Hooker, and *Cinchona succirubra*, Pavon (Hesse); also in the South American species, *Cinchona tucujensis*, Karsten, and *Cinchona lancifolia*, Mutis. It was discovered by Winckler, in 1848, in the Maracaibo bark and a certain other species, and named by him *chinidin (quinidin)*. Pasteur, having established, in 1853, that it was different from the base now known as quinidin, and isomeric with that known as cinchonin, gave it the name *cinchonidine*, which was not generally adopted until recently. Its formula was established by O. Hesse, who also found it associated with small amounts of *homacinchonidine* ($C_{19}H_{22}N_2O$), a substance which he found to be preponderate over cinchonidine, in some parcels of South American origin.

At one time the chinoidine of commerce (a mixture of cinchona bases), yielded a considerable amount of this base. It is now prepared, however, from the mother liquors obtained in preparing quinine sulphate (see table showing the amount of cinchonidine in various commercial samples of quinine sulphate by A. J. Cownley (*Amer. Jour. Pharm.*, 1886).

Description.—The alkaloid cinchonidine forms light, white, pulverulent, crystallizable masses. Sparingly soluble in cold (1680 parts), and more soluble in hot water. Alcohol (20 parts), and ether (70 parts) also dissolve it. At 206.5° C. (404° F.) it melts, and on cooling to 190° C. (374° F.) it congeals to a crystalline mass. Neutral solutions of its salts yield with Rochelle salt a crystalline precipitate insoluble in the excess of the precipitating liquid. The official body is the sulphate of the preceding alkaloid. It occurs in "white, silky, acicular crystals, without odor, and having a very bitter taste; slightly efflorescent on exposure to air. Soluble at 15° C. (59° F.), in 70 parts of water, and in 66 parts of alcohol; in 1.42 parts of boiling water, and in 8 parts of boiling alcohol. Also soluble in 1316 parts of chloroform, and almost insoluble in ether. The presence of sulphates of other cinchona alkaloids increases its solubility in ether and chloroform. At 100° C. (212° F.) the salt gives off its water of crystallization. At 215° C. (419° F.) it melts, and when ignited, it is consumed without leaving a residue. The salt is neutral, or has a faintly alkaline reaction on litmus paper"—(*U. S. P.*).

When treated with potassium sulphocyanate, either star-shaped groups of feathery, microscopic crystals, or stellate or fan-shaped groups of long, unbranched needles form. When the reagent is employed in excess, precipitation is so complete as not to cause even a turbidity when the filtrate is treated with ammonia. *Cinchotenidine* ($C_{18}H_{20}N_2O_3.3H_2O$) is formed in colorless, prismatic crystals when cinchonidine is acted upon by potassium permanganate. The same occurs with the isomer, homocinchonidine sulphate (regarded as impure cinchonidine by Skraup and Claus), which forms either in fine, white needles, or in whitish prisms. This body dissolves in 70 parts of slightly warmed water. Its saturated solution in water prepared at 50° C. (122° F.), congeals to a gelatinous, crystalline mass holding mother-liquor, from which it is not easily separable. Under like treatment cinchonine sulphate forms smooth, shining needles easily drained of their mother-liquor. Beautiful prismatic crystals (with $2H_2O$), are only produced when cinchonidine sulphate is crystallized from alcohol. If crystallized from water, according to the amount of salt and degree of concentration, the result will be either fine, silky, lustrous needles, like the official salt, or shining, square crystals, devoid of color.

Tests.—"On adding ammonia water to the aqueous solution of the salt, a white precipitate (cinchonidine) is produced, which is but slightly soluble in ammonia, but dissolves in about 75 parts of ether. If concentrated sulphuric acid be added to a small quantity of the salt, not more than a faintly yellowish color should be developed (limit of readily carbonizable, organic impurities). Upon adding to this liquid a crystal of potassium dichromate, a yellowish-green color is produced, which gradually changes to grass-green. Addition of barium chloride T.S. to an aqueous solution of the salt produces a white precipitate insoluble in hydrochloric acid. A solution of the salt (about 1 in 1000) in diluted sulphuric acid should not exhibit more than a faint blue fluorescence (absence of more than traces of the sulphates of quinine or quinidine). If 1 Gm. of the salt be dried at 100° C. (212° F.), until it ceases to lose weight, the residue, cooled in a dessicator, should weigh not less than 0.920 Gm. (absence of an undue amount of water). If 0.5 Gm. of the salt be macerated with frequent agitation, at the ordinary temperature, with 20 Cc. of water, 0.5 Gm. of potassium sodium tartrate then added, the maceration continued, under repeated agitation for 1 hour at 15° C. (59° F.), and the mixture then filtered, the addition of 1 drop of ammonia water to the filtrate should not produce more than a slight turbidity (absence of more than small proportions of the sulphates of cinchonine or quinidine)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This salt has been used as a substitute for quinine sulphate. When pure it is probably equally as efficient both as a prophylactic and remedial agent, during the prevalence of *malarial disorders*, as *intermittent* and *remittent fevers* and *miasmatic neuralgias*. It reduces the temperature even more readily than the quinine salt, and is a better tonic. It is claimed that it is not so likely to produce the unpleasant head symptoms often resulting from the use of quinine sulphate, and is pleasanter to take. Larger doses are required than of the latter salt. It may be given in doses of from 10 to 20 grains several hours before the expected chill; or where the paroxysms are mild, broken doses, 10 grains in all, may be given in the course of a day.

Specific Indications and Uses.—Periodicity, when the pulse is open and soft, the skin soft and moist, and nervous irritation absent.

Related Salts.—CINCHONIDINE HYDROBROMIDE has been administered hypodermatically (4 grains, twice a day) in *malarial disorders*, *inflammations*, and in the *summer diseases of children*.

CINCHONIDINÆ SALICYLAS, *Salicylate of cinchonidine* ($C_{19}H_{22}N_2O.C_7H_6O_3$). Needles sparingly soluble in water. Antiperiodic and antirheumatic. Dose, 15 to 20 grains in pill form as a daily allowance.

CINCHONINA (U. S. P.)—CINCHONINE.

FORMULA: ($C_{19}H_{22}N_2O$). MOLECULAR WEIGHT: 293.41.

"An alkaloid obtained from the bark of various species of Cinchona"—(*U. S. P.*).

History and Preparation.—Pelletier and Caventou, in 1820, discovered the alkaloidal nature of this principle, which had been observed before and named by Gomez (see *Cinchona alkaloids*). Most of the cinchonas yield it, the pale bark furnishing it most abundantly. According to a former Parisian Codex, cinchonine may be obtained by exhausting 125 parts of powdered pale bark, by 3 successive boilings with 2⅔ parts of hydrochloric acid, and 500 parts of water, successively (so that 8 parts of acid and 1500 parts of water will be employed in the three boilings). Mix the decoctions, and then add 12½ parts of quicklime diffused in water, and when precipitation is completed wash and dry the precipitate. Dissolve this in boiling alcohol, filter the solution while hot, distill in a water-bath, evaporate to dryness, digest in cold alcohol, and then dissolve the residue in boiling alcohol, with the addition of some animal charcoal; again filter while hot, and allow the cinchonine to crystallize spontaneously on the cooling of the liquid (*Par. Cod.*). Cinchonine may best be made from the mother-waters after sulphate of quinine has been prepared; the process is to considerably dilute the mother-waters with water, and then add ammonia; the precipitate thus formed is collected on a filter, washed, dried, and manipulated in the same manner cited.

The sulphate, acetate, hydrochlorate, etc., of cinchonine are made by dissolving cinchonine in the required diluted acid, filtering, evaporating, and crystallizing.

Description.—Cinchonine or cinchonia crystallizes readily in anhydrous, quadrilateral prisms bounded by oblique facets. It is a strong base, combining readily with acids. Cinchonine may be obtained by precipitating its salts with aqua ammoniæ, in which it is almost insoluble; it crystallizes readily from alcohol. The salts of cinchonine are bitter, and bear considerable analogy to those of quinine. The solution of cinchonine sulphate, however, when pure, is not fluorescent, and, unlike quinine, does not give the thalleioquin reaction. An alcoholic, or acidulated aqueous solution of cinchonine possesses the property of right-hand rotatory polarization. The formula of cinchonine was found by Laurent to be $C_{19}H_{22}N_2O$, which was confirmed by Skraup, and is now accepted by the *U. S. P.* in preference to the old formula of Pasteur ($C_{20}H_{24}N_2O$). The *U. S. P.* describes cinchonine as occurring in "white, lustrous prisms or needles, without odor, at first almost tasteless, but soon developing a bitter after-taste; permanent in the air. Soluble at 15° C. (59° F.), in 3760 parts of water, and in 116 parts of alcohol; in 3500 parts of boiling water, and in 26.5 parts of boiling alcohol. Also soluble in 526 parts of ether, and in 163 parts of chloroform. At 240° C. (464° F.), the crystals fuse together, and at 258° C. (496.4° F.), they melt, forming a brown liquid. When ignited, they are consumed without leaving a residue. When placed on moistened red litmus paper, cinchonine shows an alkaline reaction"—(*U. S. P.*). Cinchonine sublimes without undergoing change, forming large crystals when heated in a current of an indifferent gas, *e. g.*, hydrogen (Husemann and Hilger), sublimation beginning at 220° C. (428° F.) (Hesse). Sulphuric acid in excess in the presence of heat, renders cinchonine amorphous (Winckler). Cinchonine, though permanent in the air, will absorb sufficient carbon dioxide in the atmosphere to cause it to feebly effervesce when treated with acids. Cinchonine or any of its salts are soluble in chlorine water without being decomposed. Such a solution precipitates *white* with ammonia (compare thalleioquin test under *Quinine*). Of its salts, the oxalate, gallate, and neutral tartrate are soluble in hot water, acids (in excess), and alcohol, but not in cold water, while the latter dissolves the acetate, hydrochlorate, nitrate, phosphate, and sulphate of cinchonine.

Distilled with caustic potash *quinoline* is produced (Gerhardt), together with pyridine and its homologues. Oxidation of the alkaloid or its salts with potassium permanganate yields, besides formic acid, *cinchotenine* ($C_{18}H_{20}N_2O_3+3H_2O$), a neutral body, and an alkaloid, *hydrocinchonine* ($C_{19}H_{24}N_2O$). Cinchotenine may also be obtained by oxidation of cinchonine or its salts with plumbum dioxide and sulphuric acid. Further action of potassium permanganate and other oxidizing agents upon cinchonine results in the formation of acids, these being quinoline and pyridine derivatives, *e. g.*, *quinoline-carbonic acid* (*cinchoninic acid*) ($C_9H_6N.COOH$), and the pyridine derivative *pyridine-dicarbonic acid* (*cinchomeronic acid*) ($C_5H_3N.[COOH]_2$) (Weidel). *Cinchene* ($C_{19}H_{20}N_2$), a volatile, crystallizable base, is formed when alcoholic potassa and cinchonine chloride are boiled together (Kœnigs, 1881). By exposing to a heat of 130° C. (266° F.), a mixture of absolute alcohol, caustic soda, and cinchonine, a permanent, oily base having the composition $C_{20}H_{26}N_2$, was obtained by Michael in 1886. The commercial cinchonine was found to contain *cinchotine* (of Skraup) ($C_{19}H_{24}N_2O$), the hydrocinchonine of Caventou and Willms.

Tests.—"On adding to a neutral or not more than faintly acid solution of cinchonine, or any of its salts, enough potassium ferrocyanide T.S. to redissolve the precipitate first formed, and afterward an acid, a golden-yellow precipitate will be formed, which, when redissolved by gently warming the liquid, will separate, on cooling, in minute scales or needles. On adding an excess of ammonia water to a solution of cinchonine in a dilute acid, the alkaloid will be precipitated. The precipitate is but feebly soluble in ammonia and should require not less than 300 parts of ether for solution. A solution of cinchonine (1 in 1000) in diluted sulphuric acid should not exhibit more than a faint blue fluorescence (absence of more than traces of quinine or quinidine). Cinchonine should not impart more than a faintly yellowish tinge to concentrated sulphuric acid (limit of readily carbonizable organic impurities)"—(*U. S. P.*).

Action and Medical Uses.—(See *Cinchoninæ Sulphas*).

CINCHONINÆ SULPHAS (U. S. P.)—CINCHONINE SULPHATE.

FORMULA: $(C_{19}H_{22}N_2O)_2H_2SO_4+2H_2O$. MOLECULAR WEIGHT: 720.56.

SYNONYM: *Cinchoniæ sulphas* (*U. S. P.*, 1870).

Preparation.—The process of the *U. S. P.* (1870) is essentially as follows: Render the mother-liquor obtained in the preparation of quinine sulphate alkaline by adding gradually, with continued stirring, a sufficient quantity of solution of soda. Collect the precipitate which falls, place it on a filter and wash it with water (to remove sodium sulphate) and dry it. Next wash it with alcohol in successive portions to remove other alkaloids which may be present and soluble in that medium. Add to the residue 8 times its weight of water, heat the mixture, and add gradually sulphuric acid until saturation is effected, and the mixture becomes clear. Boil the liquid with animal charcoal (*unpurified*), filter while yet hot, and set aside, that crystals may form. Drain the crystals and dry them on paper. By further treatment of the mother-liquid (concentration), more crystals may be obtained.

Winckler has shown that an excess of sulphuric acid in the presence of heat renders cinchonine amorphous; therefore care should be had that the acid be not in excess. This is obviated to an extent by employing animal charcoal which has *not been purified* (bone black), the calcium carbonate present tending to neutralize the free acid.

Description and Tests.—Cinchonine forms two sulphates, the acid sulphate (see *Related Compounds*), and the neutral sulphate, or the official salt. It forms "hard, white, lustrous, prismatic crystals, without odor, and having a very bitter taste; permanent in the air. Soluble at 15° C. (59° F.), in 66 parts of water, and in 10 parts of alcohol; in 13.59 parts of boiling water and in 3.25 parts of boiling alcohol. Also soluble in 78 parts of chloroform, but almost insoluble in ether. At 100 C. (212° F.) it gives off its water of crystallization, and at 215° C. (419° F.)

it melts, forming a brown liquid. When ignited, it is consumed without leaving a residue. The salt is neutral to litmus paper. Addition of ammonia to an aqueous solution of the salt produces a white precipitate which should respond to the reactions and tests given under *Cinchonina*. On adding barium chloride T.S. to an aqueous solution of the salt, a white precipitate is produced, which is insoluble in hydrochloric acid. A solution of the salt (1 in 1000) in diluted sulphuric acid should not exhibit more than a faint blue fluorescence (limit of quinine or quinidine). If 1 Gm. of the salt be dried at 100° C. (212° F.), until it ceases to lose weight, the residue, cooled in a desiccator, should weigh not less than 0.95 Gm. (absence of an undue amount of water). If 1 part of the salt, reduced to powder, be macerated with frequent agitation, at the ordinary temperature with 80 parts of chloroform, it should wholly or almost wholly, dissolve (limit of quinine or cinchonidine). The salt should not impart more than a faintly yellowish tinge to concentrated sulphuric acid (limit of readily carbonizable, organic impurities" (*U. S. P.*).

Benzene and benzin do not dissolve this salt, but acids freely effect its solution. The solutions of cinchonine sulphate are very bitter, and are not fluorescent. If a drop of the saturated solution in water be placed in the field of the microscope, and a drop of potassium sulphocyanate solution be added, long, branched, radiating, anther-like crystals will be seen to form. Like cinchonine, the commercial sulphate yields *cinchotine* (Caventou and Willm's *hydrocinchonine*) ($C_{19}H_{24}N_2O$), which dissolves in alcohol more easily than cinchonine. Cold permanganate of potassium solution does not affect it, and its sulphate forms sharp, acicular crystals. It is separated from cinchonine by precipitating it fractionally. Cinchonine sulphate contains 82.8 per cent of base.

Action, Medical Uses, and Dosage.—In the main, the physiological action of cinchonine and its sulphate agrees closely with that of quinine. It is said, however, to be more poisonous to dogs and frogs than quinine sulphate. As an antiperiodic, it may be used where the patient can not take the quinine salt, though the dose must be larger than that of the latter, and, according to some, it is a less reliable agent. Its advantages over quinine are its cheapness, its greater solubility, its pleasanter taste, and its freedom from producing the gastric and head symptoms (tinnitus and disordered vision) of the latter, while, on the other hand, it is charged with producing a peculiar frontal oppression and pain, besides muscular debility, faintness, tendon-jerking, and pain in the region of the heart. The dose should be at least a third larger than that of quinine sulphate. Dose of cinchonine sulphate, as a tonic, from 1 to 2 grains; as an antiperiodic, 5 to 10 grains, about 3 doses generally being sufficient to prevent the recurrence of the chill.

Specific Indications and Uses.—Periodicity, when the pulse is open and soft, the skin moist and soft, and nervous irritation absent.

Related Compounds.—ACID CINCHONINE SULPHATE ($C_{19}H_{22}N_2O.H_2SO_4.3H_2O$). This salt is prepared by adding diluted sulphuric acid to the neutral sulphate, and crystallizing. It forms rhombic-octahedral crystals containing 59.2 per cent of the base; soluble in less than one-half part of water and in alcohol 90 parts; insoluble in ether. It becomes opaque when exposed to dry air.

CINCHONINE HYDROCHLORIDE ($C_{19}H_{22}N_2O.HCl.2H_2O$).—Prepared in crystals resembling quinine sulphate by adding cinchonine in excess to diluted hydrochloric acid. Soluble in boiling water (1 in 3.2), and in cold water (1 in 24), chloroform (1 in 22.2), alcohol (1 in 1.3 of 80 per cent), and ether (1 in 273.) It contains 80.24 per cent of base, and melts near 130° C. (266° F.). It does not fluoresce in solution like quinine sulphate, and forms with silver nitrate a white precipitate. It may thus be distinguished from the latter salt, for which it is sometimes substituted, or used in adulterating.

CINNAMOMUM.—CINNAMON.

The barks of numerous species of *Cinnamomum*.

Nat. Ord.—Laurineæ.

Three kinds of cinnamon are official in the *U. S. P.*, viz.:

I. CINNAMOMUM CASSIA (*U. S. P.*), *Cassia cinnamon* (*Cinnamomum of U. S. P., 1880*), *Cassia bark*. "The bark of the shoots of one or more undetermined species of *Cinnamomum* grown in China (*Chinese cinnamon*)"—(*U. S. P.*).

II. CINNAMOMUM SAIGONICUM (*U. S. P.*), *Saigon cinnamon.*—"The bark of an undetermined species of *Cinnamomum*"—(*U. S. P.*).

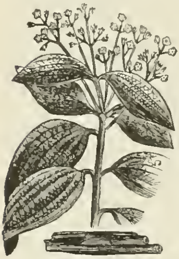
III. CINNAMOMUM ZEYLANICUM (*U. S. P.*), *Ceylon cinnamon* (*Cinnamomum, U. S. P.*, 1880). "The inner bark of the shoots of *Cinnamomum zeylanicum*, Breyne"—(*U. S. P.*). (*Laurus Cinnamomum*, Linné).

COMMON NAMES: I. *Cassia cinnamon, Cassia bark, Chinese cinnamon, Cassia lignea.*
II. *Saigon cinnamon.*
III. *Ceylon cinnamon, Cinnamon bark.*

ILLUSTRATION: *Cinnamomum zeylanicum*, Bentley and Trimen, *Med. Plants*, 224.

Botanical Source and History.—The trees yielding cassia or Chinese cinnamon are of several undetermined species cultivated in China and India. According to Charles Ford (*Jour. Linn. Soc.*, 1882), the *Cinnamomum Cassia* of Blume yields the true cassia bark of the Chinese. Many other species have been thought, however, to yield a portion of this bark. Chinese cinnamon proper is the product of a wild tree growing in Annam, and should not be confused with cassia cinnamon. It never occurs in our commerce, being consumed entirely in China, to which country it is exported. The cassia barks from Sumatra and Java, the latter being of excellent quality, are said to be the products of *Cinnamomum Cassia*, Blume, and *Cinnamomum Burmanni*, Blume. Indian cassia is derived in part, at least, from several species of India, which are by many botanists considered but varieties of the Ceylon cinnamon tree. They are the *Cinnamomum Tamala, C. nitidum*, and *C. iners. Cinnamomum Burmanni* var. *Kiamis* yields *Massoy-bark*. The botanical source of Saigon cinnamon is unknown. In fact the source of the species yielding cassia bark is but little known, excepting that of the Ceylonese bark.

Fig. 74.



Branch and bark of Cinnamon plant.

Cassia bark does not come in commerce with the quills telescoped (in the form of quills within quills) like the Ceylon bark. They are usually single, though sometimes double, and are tied together in bundles with bamboo. It is gathered from March to May from trees of about the sixth year's growth. The branches after being cut, are carried to a building where the shoots, after being deprived of leaves and twigs, are twice cut longitudinally through the bark, after which cross-incisions are made at intervals of about 16 inches. The bark is then detached by a curved horn-knife, and while still pliable is laid inner surface downward, and the epidermis detached with a plane. It is then dried for a day, and tied in bundles of about the diameter of the length of the pieces (Ford).

Cassia cinnamon is, in fact, a mixture of a variety of different qualities of cinnamon. It is generally met with in cylindrical rolls or quills of various sizes, from 2 to 12 lines in diameter, or in semi-tubular segments, 12 to 18 inches long, with the external layer much thicker than that of cinnamon; externally more of a dark red, traversed with thicker and more shining, straight or serpentine veins; more fibrous and paler in fracture; internal layer coarsely fibrous; heavier and more compact, with an odor similar to that of cinnamon, but not so strong or agreeable, and a corresponding taste more acrid, burning, and lasting, and at the same time mucilaginous. It is used in tinctures instead of cinnamon, and is the kind usually sold as cinnamon.

Saigon cinnamon comes in unscraped pieces or quills. *Java cinnamon* may resemble the Ceylon variety, though its flavor is not considered so fine; or it may resemble the better grades of cassia cinnamon, though its flavor is of a better quality. *Cayenne cinnamon* is somewhat mucilaginous, and is of a reddish hue.

Cinnamomum zeylanicum, Breyne (*Laurus Cinnamomum*, Linné).—This tree has a rough bark, and grows from 15 to 25 feet or more high, having a trunk from 1 to 1½ feet in diameter. Its branches are somewhat 4-cornered, and smooth; the leaves are ovate, or ovate-oblong, from 6 to 9 inches long, 2 or 3 inches broad, tapering into an obtuse point, triple-nerved, reticulated on the under side, smooth, with the uppermost the smallest, opposite, and coriaceous. Its flowers are small, hoary, silky, and white; the segments oblong and deciduous in the middle; the panicles are terminal and axillary, and stalked (L.—*Ed.*—P.).

Cinnamomum zeylanicum is a native of Ceylon, Sumatra, Borneo, etc., and is cultivated in many parts of both the new and old world. The bark is the official part; it has the odor peculiar to cinnamon, and an agreeable, warm, aromatic flavor, with a mild degree of sweetness. The leaves are similar in taste and odor, but less powerful, and contain a volatile oil, which may be procured by distillation. The odor of the flowers is to most people disagreeable, like newly-sawn bones (*Ed.*). The tree throws out no fragrance beyond its immediate sphere. The bark is the true cinnamon of commerce. It is usually collected from trees about 9 years old. The plant is kept pruned in such a manner that the shrub forms "stools," and from these a few shoots are produced, which, when about 2 years old, or just as the corky layer begins to appear (the bark beginning to change to a brown color), are cut, deprived of their leaves, and prepared for market. The peeling of the shoots and branches commences in May, and continues until the latter part of October. The bark is freed from its epidermis, and then dried, first in the shade, and afterward under exposure to the sun; it curls in drying into quills, which are subsequently placed within each other, as they will admit. The best bark comes from Ceylon, and is in the form of rolls about $\frac{1}{2}$ inch in diameter, and from 30 to 40 inches long, and composed of many quills within each other. The fragments of bark obtained in preparing the shoots are sold in the market as *cinnamon chips*. Cinnamon quills have a light-yellow color, and are thin, smooth, shining, a little thicker than cartridge paper, and break readily with a splintery fracture, being easily pulverizable. They possess a rich, pure, peculiar odor, and a warm, spicy, sweetish, and agreeable taste, and yield their virtues to water, but more readily to alcohol or spirits. A small amount of volatile oil may be procured from it by distillation. The thick, dark-brown, and feebly-flavored bark is of an inferior quality. Cinnamon is often adulterated with the poorer sorts, and likewise with the bark after having been deprived of its oil.

Description.—The following are the Pharmacopœial descriptions of the three varieties of cinnamon:

I. Cinnamomum Cassia (*U. S. P.*), *Cassia cinnamon.*—"In quills of varying length and about 1 Mm. ($\frac{1}{25}$ inch) or more in thickness; nearly deprived of the corky layer; yellowish-brown; outer surface somewhat rough; fracture nearly smooth; odor fragrant; taste sweet, and warmly aromatic"—(*U. S. P.*).

II. Cinnamomum Saigonicum (*U. S. P.*), *Saigon cinnamon.*—"In quills about 15 Cm. (6 inches) long, and 10 to 15 Mm. ($\frac{2}{5}$ to $\frac{3}{5}$ inch) in diameter, the bark 2 or 3 Mm. ($\frac{1}{12}$ to $\frac{1}{8}$ inch) thick; outer surface gray or light grayish-brown, with whitish patches, more or less rough from numerous warts and some transverse ridges and fine longitudinal wrinkles; the inner surface cinnamon-brown or dark-brown, granular, and slightly striate; fracture short, granular, in the outer layer cinnamon-colored, having near the cork numerous whitish striæ forming an almost uninterrupted line; odor fragrant; taste sweet, warmly aromatic, somewhat astringent"—(*U. S. P.*).

III. Cinnamomum Zeylanicum (*U. S. P.*), *Ceylon cinnamon.*—"Long, closely rolled quills, composed of 8 or more layers of bark of the thickness of paper; pale yellowish-brown; outer surface smooth, marked with wavy lines of bast-bundles; inner surface striate; fracture short-splintery; odor fragrant; taste sweet and warmly aromatic"—(*U. S. P.*).

Chemical Composition.—The various species of cinnamon differ but little chemically, the chief constituent being their volatile oil (see *Oleum Cinnamomi*), which occurs to the amount of 1 per cent in cassia bark, but more sparingly ($\frac{1}{2}$ to 1 per cent) in that from the Ceylon variety. The latter, however, has by far the finer flavor. The principal constituent of cinnamon oil is *cinnamic aldehyde* ($C_6H_5CH : CH\ CHO$) together with cinnamyl-acetic ester and a little cinnamic acid. Holmes, in 1890, obtained from the oil distilled from the leaves *eugenol*, as chief constituent; a hydrocarbon resembling cymene in odor, little benzoic acid, and less cinnamic aldehyde. Cinnamon, according to the older analysis by Vauquelin, contains volatile oil, tannic acid (see investigation by T. R. Thornton, *Amer. Jour. Pharm.*, 1895), coloring matter, resin, an acid (cinnamic), and ligneous fiber; starch has been found in it. S. Martin, in 1868, obtained *cinnamomine*, a body identified as *mannite* by Wittstein, in 1869. Ceylon cinnamon leaves upon incineration about 4 or 5 per cent of ash.

Action, Medical Uses, and Dosage.—Stimulant, tonic, stomachic, carminative, and astringent; also reputed emmenagogue, and capable of diminishing the secretion of milk. The tincture of the bark is useful in *uterine hemorrhage* and *menorrhagia*, given in drachm doses in sweetened water, and repeated every 5, 10, or 20 minutes, or as may be required. A tincture of the oil (ʒj) in 98 per cent alcohol (℥viii), is preferable, given in from 5 to 30-drop doses, repeated as often as necessary. For *post-partum* and other *uterine hemorrhages*, it is one of the most prompt and efficient remedies in the Materia Medica. To a limited extent it controls hemorrhage from other parts of the body, yet its most direct action is upon the uterine muscular fibres, causing contraction and arresting bleeding. Upon the nervous system cinnamon first stimulates and then depresses. Cinnamon is generally used to correct the effects, or improve the flavor of other drugs, and is one of the best additions to cinchona bark for correcting the nausea or vomiting sometimes occasioned by that drug. Internally, it is very useful in *diarrhœa*, *colic*, *cramp of the stomach*, *flatulency*, and to allay *nausea* and *vomiting*. Dose of the powder, from 5 to 20 grains; of the tincture, from 10 to 60 drops; tincture of oil, 5 to 60 drops. Specific cinnamomum, 10 to 60 drops (see *Oil of Cinnamon*).

Specific Indications and Uses.—Post-partum and other uterine hemorrhages with profuse flow, cold extremities, and pallid surface; hæmaturia; hæmoptysis.

Related Products.—Cassia Buds (*Flores cassiæ*) or *Clavelli cinnamomi*. The immature pedicellate fruits of one or several species of Cinnamomum. Though smaller, they resemble cloves somewhat, though their taste and odor is nearly like that of cinnamon. They contain tannin and an essential oil.

Cassia Twigs.—These are the small branches of the same tree yielding cassia lignea. They are about 2 feet long, vary in thickness, and possess a cinnamon flavor.

Ishipingo.—The calyx of a lauraceous tree common to Peru and Ecuador. It consists of an enlarged, woody calyx from $1\frac{1}{2}$ to 2 inches broad, funnel-shaped though shallow, the cup-like cavity being surrounded by an irregular, broad, usually recurved margin. It is of a deep-brown color, smooth internally, and veiny and rough on the exterior. Its taste is sweet and aromatic, resembling that of cinnamon, for which it is employed as a substitute in Ecuador. The bark of the twigs resembles cinnamon, being furnished in small quills (*Pharmacographia*).

Clove Bark or Cassia Caryophyllata (*Cortex caryophyllatus*).—This Brazilian bark has a cinnamon-like, mucilaginous taste and the odor of cloves. It is the product of *Dicypellium caryophyllatum*, Nees. The bark is thin ($\frac{1}{16}$ inch), smooth, or slightly rugose, is of a rich brown color, occasionally bluish-brown, and when broken displays a nearly white line close to the external margin. It breaks with a short fracture. It is occasionally found in market, but is most largely employed in Brazil as a substitute for cinnamon, whose properties it resembles.

Culilawan Bark.—This bark, employed by the natives of Molucca and occasionally sold on the market, is the product of *Cinnamomum Culilawan*, Nees. It comes in somewhat thick ($\frac{1}{10}$ to $\frac{1}{4}$ inch) curved or flat pieces. It breaks with a short, fibrous, somewhat corky fracture, and has internally a brownish color, while on the external surface it is gray or brown. It has a mucilaginous, aromatic taste, and a mixed odor of cinnamon, sassafras, and cloves.

Massoy Bark.—Several aromatic barks bear this title. A New Guinea bark yielded a an oil to Schimmel & Co., resembling that of cloves and nutmeg. The true massoy barks, however, are those believed to be derived chiefly from the *Cinnamomum Burmanni* var. *Kiamis*, *Cinnamomum xanthoneuron*, and *Sassafras gœsianum* (see *P. J. Trans.*, 1888).

CIRSIUM.—CANADA THISTLE.

The root of *Cirsium arvense*, Scopoli.

Nat. Ord.—Compositæ.

Common Names: *Canada thistle*, *Cursed thistle*.

Botanical Source.—This plant, called in England *Cursed thistle*, has a perennial, creeping, very long root, extremely tenacious of life, with a stem 3 or 4 feet in height, having a branching panicle at the top. The leaves are alternate, oblong or lanceolate, sessile, smooth, or slightly woolly beneath, sinuate-pinnatifid, and prickly margined. The heads are rather small, numerous, and imperfectly diœcious. The flowers are rose-purple. The involucre round or ovate, with minute spines; and the scales close pressed, and ovate-lanceolate (W.—G.).

History.—Canada thistle grows in various sections of the United States, in cultivated fields and pastures, roadsides, and waste places, flowering from June to August. It is an extremely troublesome plant to the farmer, requiring his utmost vigilance to extirpate it from his fields. The involucre is the only part of the plant that can be handled with safety. The root is the part employed, which yields its properties to water. Herman J. Pierce has made a chemical analysis and found a volatile alkaloidal principle difficult to obtain crystalline, of narcotic odor, soluble in ether, chloroform and alcohol; an organic acid, resin, etc., while starch, tannins and glucosids were absent (*Amer. Jour. Pharm.*, 1896, p. 529).

Action, Medical Uses, and Dosage.—Tonic and astringent. Used principally, boiled with milk, in *diarrhœa* and *dysentery*; some recommend the addition of dried codfish skin to the decoction. Also. used as a local application to some *cutaneous diseases*, *ulcers*, and in *leucorrhœa*.

CLEMATIS.—VIRGIN'S BOWER.

The fresh stems, leaves, and blossoms of *Clematis virginiana*, Linné.

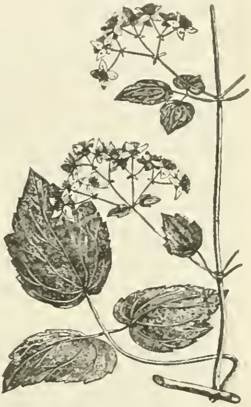
Nat. Ord.—Ranunculaceæ.

COMMON NAMES: *Virgin's bower, Ladies' bower, Love vine, Traveler's ivy.*

ILLUSTRATION: Lloyd's *Drugs and Med. of N. A.*, Vol. I, Pl. 1.

Botanical Source.—Clematis virginiana is a perennial, climbing plant, with a stem from 8 to 15 feet or more in length, supporting itself on shrubs, fences and brushwood, by means of its long petioles. The leaves are opposite, deep-green, and ternate; the leaflets ovate, cordate, acuminate, lobed, cut-dentate, and from 2 to 3 inches in length by 1 or 2 in breadth. The flowers are in paniculate clusters, and diœcious; the panicles being large, axillary, and dichotomous. Sepals 4, white, spreading, oval-oblong, obtuse-petaloid. Stamens from 28 to 36. The fruit is furnished with long, plumose tails, appearing in large, downy tufts. The seeds are compressed (W.).

Fig. 75.



Clematis virginiana

History.—The Clematis virginiana is a native of the United States, and grows by river banks, in hedges and thickets, from Canada to Georgia and the Mississippi. It flowers in July and August; the parts used are the bark, leaves, and blossoms, which yield their virtues to water or alcohol. The leaves should be gathered when they are fully grown, say in August. The fresh drug only should be employed, as most of its properties are dissipated in drying. Clematis is not found as a drug in commerce. Alcohol takes up the properties of clematis, yielding a green tincture, which, upon exposure to light, turns brown. This and all of the below-mentioned species of Clematis have been used in medicine to some extent, but only this species and *Clematis recta* are now employed, and chiefly in domestic practice and by Homœopathic physicians. Though never favorite remedies, they have probably fallen into undeserved neglect on account of having been used in the dried instead of the fresh state. They should be given a proper trial, and their worth or worthlessness established.

Description.—The leaves and flowers are described above. "The stem attains a diameter at the base from ½ inch to 1 inch, and has a spongy, ligneous texture. When recent, it is covered with a thin brown bark. The wood is coarsely divided into distinct medullary rays, between which, when the plant is recent, are deposited layers of a greenish substance, which contains the acrid principles." (J. U. Lloyd, in *Drugs and Med. of N. A.*, Vol. I, p. 7).

Chemical Composition.—According to Rafinesque (1830) a peculiar body resembling gluten, and known as *clematin*, exists in the flowers of *C. virginiana* and *C. Viorna*. The fresh plant (*Clematis virginiana*), according to Prof. J. U. Lloyd, who examined it chemically, has a peculiar, unpleasant odor, and a taste at first rank and disagreeable, but, after prolonged chewing, becomes acrid and irritating, not followed by pain, but rather leaving "a dry, metallic-like roughness of the tongue and mouth." When distilled with water a neutral distillate, having an odor recalling that of skunk-cabbage, was obtained. This odor may be removed by agitation with chloroform or benzol. If this solution be spontaneously evaporated, "a colorless, oily substance remains, which is the characteristic principle of the plant, but which evaporates by exposure." He found the distillate, when inhaled, to be a pulmonary irritant, giving a sensation similar to that produced by sulphurous acid gas. No alkaloid, either volatile or fixed, was found. Besides the usual plant constituents the plant contains grape-sugar. (See paper by Prof. J. U. Lloyd, in *Drugs and Med. of N. A.*, Vol. I, p. 10).

Action, Medical Uses, and Dosage.—The various species of clematis, when applied to the skin in a fresh state, blister it; and if taken internally, act as corrosive poisons. Both drying and boiling destroy the virulent property. They have been used externally in the treatment of several *cutaneous affections*, and in form of a liniment, made with oil, for the cure of *itch;* internally, as diuretics and sudorifics in *chronic rheumatism*, *palsy*, etc., in minute doses. The extract, in doses of 1 or 2 grains, is recommended for *osteocopic* pains. The green leaves bruised are sometimes employed to produce vesication, also, as an escharotic and detergent for *venereal* and other foul and *indolent ulcers.*

Clematis virginiana has been highly spoken of as a nervine in *uterine diseases.* Place 2 drachms of the dried leaf into a cup filled with hot water, cover it, and allow it to stand until the liquid is cool enough to drink; strain, sweeten with sugar if desired, and let the patient drink it at once. Repeat as often as may be required, the doses being regulated by its effects upon the system.

Like *Clematis recta* (which see), this species produces painful eczema-like eruptions, which may result in small painful ulcerations. Prof. E. M. Hale, M. D., has found it fully equal to *Clematis recta*, being particularly useful in *nervous erethism*, *insomnia*, *neuralgic and rheumatic headache*, *toothache*, *reflex neuroses of women* from ovarian or urinary irritation, *neuroses of men* with *pain* in testicles and bladder, *cystitis*, *urethritis*, *gonorrhœa*, *orchitis*, and *swellings of the inguinal glands.* Following the law of *similia*, he also found it useful in "*eczema*, *herpes zoster*, and *pustular eruptions* on the scalp and face of children." A good tincture may be prepared as follows: Clematis (fresh stem, leaves, and flowers), 1 part; alcohol, 2 parts; bruise to an even pulp, add the alcohol, mix thoroughly, and allow to macerate in a close vessel for 10 days. Express and filter (*D. and M. of N. A.*). As clematis acts very much after the manner of pulsatilla and its congeners, it should be tried in fractional doses in the complaints for which such drugs have an established reputation. (For uses of other species see *Related Species*). Dose, $\frac{1}{10}$ to 5 drops, well diluted.

Related Species.—Prof. Landerer, of Greece (1877), reported a case of *epilepsy* cured after futile attempts with other medicine, by a species of Clematis, either *C. cirrhosa* or *C. sylvestris.* Also rubefacient and vesicant.

Clematis recta (*erecta*), Linné. *Upright Virgin's bower.*—The *Flammula Jovis* of old medical writers and the first species introduced as a medicine (*D. and M. of N. A.*). This species, like others of its family, will produce a painful pustular, eczema-like eruption, which may result in blebs or bullæ, and even develop into small painful ulcers. It has been used to some extent in Homœopathy, and is mentioned by Prof. Webster (*Dynam. Therap.*) in the conditions named below. It appears to affect both the male and female reproductive organs, influencing both the testes and ovaries. *Ovarian indurations* and *chronic gonorrhœal orchitis* are said to be relieved by it. It is also reputed useful in other after-effects of *gonorrhœa*, as *gleet* and *incipient stricture.* It relieves *irritation of the urinary tract*, especially the *vesical irritation* of nervous women with ovarian derangements. *Dysuria* and *urinal retention* are also occasionally benefited by it. Homœopathists employ it in *chronic scrofulous* and *syphilitic skin diseases*, especially when mercurialization has been carried too far. Foul, vesicular, and pustular *eruptions*, *ulcers*, *syphilitic excrescences*, *eczema*, and *irritated and swollen eyelids*, involving the meibomian glands, are conditions in which they claim success from its use. A Homœopathic tincture may be used in the proportion of 10 to 15 drops to 4 fluid ounces of water, the dose of which is a teaspoonful several times a day. Störck (1769) employed Clematis recta in *old ulcers*, *secondary syphilis headache*, and *carcinoma.* He also pointed out its diuretic action, a view confirmed by Prof. Sauveur, in 1866, who claims to have cured *Bright's disease* with its infusion.

Clematis Vitalba, Linné.—The common species of Europe and only one in England. "*Virgin's bower*, *Traveler's joy*, *Love vine*, *White vine*, *Ladies' bower*, *Old Man's beard*, *Smoke wood*, *Wild vine*, *Bind-with*, *Hedge vine*, and *Climbers*" (*D. and M. of N. A.*), *Wild clematis.* Gaube extracted a principle from this plant to which he gave the name *clematine.* It is alkaline, and forms a neutral compound with sulphuric acid, which crystallizes in hexagonal needles. Besides this principle, he also detected an essential oil, to which it owes it properties, tannin, mucilaginous substances, and a small amount of earthy salts.

The seeds of clematis, given in infusion, have been found serviceable in *albuminuria*, even when general *anasarca, amblyopia, incipient hypertrophy of the left ventricle*, without valvular lesion, and which condition is, as M. Traube has shown, always a result of abnormal conditions of the kidneys, and other symptoms peculiar to this disease were present. The effects of the remedy were quite prompt, a profuse diuresis, followed by a gradual diminution of albumin in the urine, and a rapid disappearance of the anasarca, and other symptoms. This infusion has likewise proved efficient in other serous affections due to other maladies of the abdominal viscera (Prof. Sauveur, 1886). The roots of the *C. Vitalba*, boiled for a short time to diminish their acrimony, and then infused in boiling oil, were applied to the skin several times a day, in *itch*, and a cure was effected in 12 or 15 applications. The plant, boiled in oil and mixed with wax and verdigris, was formerly esteemed a remedy for *tinea*.

Clematis Viorna, Linné, or *Leather flower*, which is more common in the western states, and may be found growing in woods from Pennsylvania southward, may, probably, be employed as a substitute for the above. It differs from it in having a cylindrical, striate stem; with opposite, decompound, pinnately divided leaves, consisting of from 9 to 12 ovate-lanceolate leaflets, acute at each end, entire or 3-lobed; flowers large, purple, nodding, solitary, axillary, campanulate; sepals thick, leathery, acuminate, and peduncles from 3 to 6 inches long, with a pair of small, simple, entire leaves near the middle (W.).

Clematis Pitcheri, Torrey and Gray.—From Illinois westward. This and above species are probably varieties of the same species. It has single, dull-purple flowers, having thick, leathery, valvate sepals. It is also known as *Leather flower*.

Clematis crispa, Linné.—Southern United States. This is thought to be the most acrid of the indigenous species. It is known in the south as *Blue jasmine* and *Curled Virgin's bower*. It has single nodding flowers, with "purplish-blue sepals, with dilated thin margins" (*D. and M. of N. A.*).

Clematis Flammula, Sweet-scented Virgin's bower.—France and other parts of south Europe. Has fragrant white flowers and is cultivated for ornamentation (*D. and M. of N. A.*).

Clematis Viticella, Linné; *Blue clematis.*—South Europe, particularly France. Cultivated, and has blue flowers (*D. and M. of N. A.*). Formerly esteemed in *itch* and *leprosy*.

Clematis verticillaris, De Candolle; *Whorl-leaved Virgin's bower.*—Rare northern species. "It has large, 4-sepaled, purple flowers, with thin, spreading sepals" (*D. and M. of N. A.*). Cultivated for ornament.

Clematis alpina, Miller.—Southern Europe, in mountainous regions. Analogous to preceding (*D. and M. of N. A.*).

Clematis ligusticifolia, Nuttall; *Wild sarsaparilla.*—Western United States. Closely resembles *Clematis virginiana*. Root used by New Mexico Indians as an alterative (*D. and M. of N. A.*)

Clematis dioica, Linné.—Jamaica. Used as a rubefacient (*D. and M. of N. A.*). The root, boiled with sea water, acts as a powerful hydragogue cathartic, and is useful in *dropsy;* and an infusion of the leaves and flowers removes *spots* and *freckles* from the skin.

Clematis mauritiana, Linné.—Madagascar. "Probably the most acrid of all the genus" (*D. and M. of N. A.*). Employed by the negroes of the Isle of France to blister the cheek for the relief of *toothache*.

CNICUS BENEDICTUS.—BLESSED THISTLE.

The leaves and flowering heads of *Cnicus benedictus*, Gaertner (*Centaurea benedicta*, Linné; *Carduus benedictus*).

Nat. Ord.—Compositæ.

Common Names: *Blessed thistle, Holy thistle.*

Botancial Source.—Blessed thistle is an annual, branched, woolly plant, with a fibrous, whitish root, sending out several roundish, reddish stems, 1 or 2 feet high. The leaves are amplexicaul, somewhat decurrent, nearly entire, pinnated or deeply pinnatifid, more or less hairy; the upper leaves sessile; the lower ones petioled. The flowers are yellow, and borne in terminal bracteate heads. Involucre ovate; scales close-pressed, coriaceous, extended into a long, hard, spiny, pinnated appendage; lateral spines conical and distant. The florets of the ray are sterile, slender, and as long as those of the disk. Fruit longitudinally and regularly striated, smooth, with a broad, lateral scar. Pappus triple, as it were; the outer being the horny, short, crenated margin of the fruit; the intermediate consisting of 10 long, stiff setæ; the inner, of 10 short setæ; all the setæ alternating with each other (L.).

History.—This plant is common to southern Europe and the Levant, and has been introduced into this and several other countries. It flowers in June, at which time the leaves and tops should be collected, as the plant is at its highest degree of medicinal power; they should be thoroughly and speedily dried, and be kept free from moisture, light, and free access of air. Their odor is faint and rather disagreeable, and their taste is exceedingly bitter. Their properties are yielded to water or alcohol, forming a pleasantly-bitter draught when infused with the former fluid, but a sickening and repulsive decoction.

Chemical Composition.—The leaves yield, upon analysis, an amorphous, brownish-yellow, bitter principle, resin, a fixed oil, gum, sugar, albumen, some salts, etc. The bitter principle was discovered, in 1839, by Nativelle and by him named *cnicin* ($C_{42}H_{56}O_{15}$, Scribe), and is supposed to be the active constituent of the plant. It crystallizes in transparent white needles, which have a bitter taste, are odorless, neutral, unaffected by the atmosphere, are fused and decomposed by heat, slightly soluble in cold, but more so in boiling water, sparingly soluble in ether, but readily in alcohol. Chemically it approaches salicin. Vomiting is produced by it in doses of 5 or 6 grains; 7 or 8-grain doses have proved beneficial in periodical fevers (see *Chem. Gaz.*, Vol. II, p. 462).

Action, Medical Uses, and Dosage.—A cold infusion is tonic; a warm infusion diaphoretic and emmenagogue; and, if strong, emetic. Used as a tonic in *loss of appetite*, *dyspepsia*, and *intermittent diseases*. Valuable also in the forming stage of *febrile* and *inflammatory affections*. *Colds* may be broken up with it, and it acts well in *menstrual suppression* from cold. Dose of the powder, from 10 to 60 grains; of the infusion, 2 fluid ounces; specific cnicus benedictus, 5 to 10 drops, every 4 hours.

Related Species.—*Centaurea calcitrapa*, Linné; *Star thistle.*—Europe. Naturalized to some extent in the United States. Flowers purple, and herb has a bitter taste. Virtues like those of blessed thistle.

Centaurea cyanus, Linné; *Blue bottle*; *Corn flower.*—Europe. Naturalized and cultivated in flower gardens in the United States. Florets blue. Besides being an ingredient of some fumigating powders, these flowers have virtues similar to the preceding plants.

COCA (U. S. P.)—COCA.

"The leaves of *Erythroxylon Coca*, Lamarck"—(*U. S. P.*). This is the ERYTHROXYLON of the *U. S. P.* of 1880.

Nat. Ord.—Lineæ.

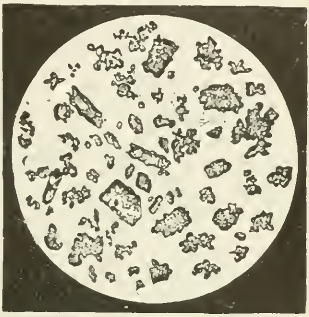
Botanical Source.—This is a shrub growing about 4 feet high, with the leaves ovate, alternate, thin, membranous, flat, opaque, acute at both ends, the apex almost mucronate, quite entire, tri-nerved in the middle with fine connecting veins on either side of the midrib, a slightly curved line extending from one end of the leaf to the other (the crossing of larger veins rendering the leaves somewhat areolated), dark-green above, paler beneath, 1½ to 2 inches long, an inch or more in their greatest width, and on short, delicate foot-stalks. The petioles are from 2 to 4 lines long, with a pair of intrapetiolary ovate-lanceolate, brown, acute stipules, upon the back of the outside of which the petiole is articulated, and from which the leaf readily falls away, leaving the branches scaly with the persistent stipules. The flowers are small, white, numerous, and borne in fascicles from the branches where the leaves have fallen away, bracteated. The peduncles are about as long as the flower, and sharply angled. Calyx 5-cleft, 5-angled at the base; segments acute. Petals 5, alternate with the calyx segments, oblong, concave, wavy, with a lacerated and much plaited membrane arising from within and above the base. Stamens 10, monadelphous; filaments longer than the pistil, combined below into a rather short cylindrical tube. Ovary oval, 3-celled, 3-seeded; styles 3, about as long as the ovary, distinct from the very base, not consolidated; stigmas thickened. The fruit (by abortion), is an oblong or ovoid drupe, 1-seeded, red, and obscurely furrowed when dry; the nut is oblong and furrowed (L.).

History.—Coca grows in moist and woody regions on the eastern slopes of the Andes, from 2000 to 10,000 feet above the level of the sea, and is highly valued and cultivated by the natives of Peru, Chili, and Bolivia, who make great use of it as a medicine, and as an article of diet. It answers as a substitute for the tea, coffee, tobacco, hashish, opium, etc., of other nations. In some sections the plant produces three crops annually. The natives masticate the dried leaves with finely powdered chalk or lime, or with a highly alkaline substance prepared from roasted potatoes and the ashes of various plants, which they call *llipta*. Its use is not confined to the rich; the poor laboring classes make great use of it as a stimulant and imaginary nutrient, as it enables them to endure fatigue and exertion for many hours, and even for several days, with but little nourishment of any other kind; and while under its influence they are said to perform prodigies of labor. The leaves after being gathered must be dried as quickly as possible, and be kept perfectly free from moisture and dampness; they then have a rather pleasant odor, recalling that of tea, and a bitter, aromatic, and slightly astringent taste.

Coca shrub has been cultivated successfully in Ceylon, India, and Java. In the latter country the cultivated species differ sufficiently from the *Erythroxylon Coca* to have been designated as the variety *E. Coca*, var. *Spruceanum*, Burck.

Description.—Two South American cocas are found in commerce. One known as *Huanuco* or *Cuzco Coca*, is derived from places of those names in Peru, the cities being located south of the central part of the state; and *Truxillo* or *Trujillo Coca*, coming from the northern portion of Peru. The latter kind has pale-green leaves, which are thin and easily broken, not so large but more pointed than those of Huanuco coca, which are coriaceous, thicker, and have a much deeper green color. The Truxillo leaf is said to be identical with that furnished by the Java shrub. Bolivian coca is regarded as finer than that grown in Peru. It is identical in appearance with the Huanuco variety. Coca is marketed in *cestos* or bags of from 25 to 50 pounds each. The *U. S. P.* thus describes coca: "Varying between ovate, lanceolate, and obovate-oblong, and from 2 to 5 or 7 Cm. (¾ to 2 or 2¾ inches) in length; short-petiolate, entire, rather obtuse or emarginate at the apex, slightly reticulate on both sides, with a prominent midrib, and on each side of it a curved line running from base to apex; odor slight and tea-like; taste somewhat aromatic and bitter. When chewed it temporarily benumbs the lips and tongue"—(*U. S. P.*).

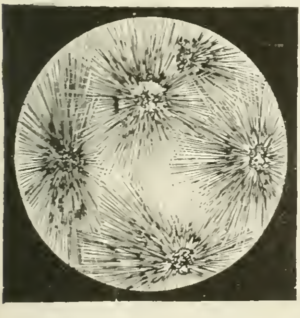
Fig 76.



Cocaine alkaloid, commercial product crystallized from alcohol. X. 50 diameters.

Chemical Composition.—Wackenroder, in 1853, failed to isolate any of the active principles of coca leaves, but obtained its peculiar tannic principle to which later the name *coca-tannic acid* was given. Several alkaloids have since been observed in coca. *Cocaine* ($C_{17}H_{21}NO_4$), was first noticed by Gædeke, in 1855, who named it *erythroxiline*, but it was better defined by Niemann, in 1860, who gave it its present name. When heated with concentrated hydrochloric acid, it is resolved into benzoic acid, methyl alcohol, and a new base called *ecgonine* ($C_9H_{15}NO_3$, or $CH_3.NC_5H_7.CHOH.CH_2.COOH$); hence *cocaine* is *methyl-benzoyl-ecgonine* (W. Lossen, 1862). Ecgonine crystallizes from alcohol in monoclinic prisms, easily soluble in water, less so in alcohol, and insoluble in ether. It has a sweetish bitter taste. Cocaine occurs in large 4 to 6-sided monoclinic prisms, and when pure, is without odor and color. Cocaine is readily soluble in chloroform, ether, carbon disulphide, benzene, petroleum ether, petrolatum (melted), and in volatile and fixed oils. It is much less soluble in alcohol than in the above solvents, while water dissolves it with difficulty (1 part in 704 at 12° C. [53.6° F.]) (Niemann); more than 1300 parts of cold water (Paul), being required. Cocaine is bitterish, and produces upon the tongue an evanescent numbness. It can not be kept in aqueous solution on account of its tendency to split into methyl-alcohol, ecgonine, and benzoic acid. Cocaine is strongly alkaline in reaction,

Fig. 77.



Cocaine hydrobromate. Crystals formed by spontaneous evaporation of aqueous solution X. 50 diameters.

producing with acids crystallizable salts, which, as a rule, are bitter, and dissolve freely in water and alcohol. Ether does not dissolve them. They all possess the property of benumbing the tongue in a greater degree than does the alkaloid cocaine. For the details of Squibb's process of preparing cocaine by percolating coca leaves with a 5 per cent solution of sulphuric acid, and abstracting the alkaloid with kerosene oil after rendering alkaline with sodium carbonate, see *Ephemeris*, 1887, p. 906.

Cocaine may also be considered a methyl derivative of *benzoyl-ecgonine* ($C_9H_{14}NO_3.COC_6H_5$), which is another alkaloid occurring in coca leaves. *Isatropyl-cocaine* ($C_{19}H_{23}NO_4$), a very poisonous, amorphous alkaloid, has also been found in this drug (Liebermann, 1888). With hydrochloric acid it splits into methyl-alcohol, ecgonine, and *isatropic acid* ($C_8H_7.COOH$), thus disclosing an analogy to cocaine, the relationship being similar to that exhibited in the class of alkaloidal bodies known as *tropeïnes* (see *Atropine*). *Cinnamyl-cocaine* ($C_{19}H_{23}NO_4$), another alkaloid existing in coca leaves, is likewise analogous to cocaine, yielding by decomposition *cinnamic acid* (Geisel), or *isocinnamic acid* (Liebermann, 1890), instead of benzoic acid. *Cocamine* ($C_{19}H_{23}NO_4$, Hesse, 1889), being present in Erythroxylon nova granatense, or Truxillo bark, in the amount of 0.6 per cent, yields *cocaic acid* ($C_9H_8O_2$), which Hesse pronounces, however, identical with *isatropic acid*. Liebermann and Geisel (1891), found in coca leaves from Java *benzoyl-pseudo-tropeine* ($C_{15}H_{19}NO_2$), which, when heated with hydrochloric acid, splits off *pseudo-tropine* ($C_8H_{15}NO$). The alkaloid *hygrine*, named by Lossen, was previously observed by Maclagan. According to Hesse (1887), it is a yellowish, strongly basic oil easily soluble in ether, chloroform, and alcohol, less so in water, forming salts with acids. Its diluted solutions in acids are fluorescent. Its formula is probably $C_{12}H_{13}N$, which points to its being a homologue of quinoline (C_9H_7N). *Cocaicine* (Bender, 1885), is one of several undetermined coca alkaloids. Among other constituents of coca leaves may be mentioned, chlorophyll, resin, traces of essential oil, the coca-tannic acid before mentioned producing a green-black color with ferric salts; a wax crystallizing from alcohol in white granules, and melting at 70° C. (158° F.) (Niemann), and inorganic salts. The amount of total alkaloids in coca leaves has been found to vary from 0.2 to 0.8 per cent, seldom reaching 1 per cent. For comparisons of assay methods, see *Amer. Jour. Pharm.*, 1895, pp. 489 and 572.

Action, Medical Uses, and Dosage.—In large doses, coca is said to cause delirium, hallucination, and finally cerebral congestion. In medium doses it acts as a stimulant, increasing the temperature of the body, as well as the respiration and frequency of the pulse; in a moderate dose it excites the nervous system in such a manner as to render the performance of muscular exertion much easier, and producing a sensation of calmness. According to Dr. Mantegazza, its use has produced an erythematous eruption resembling pityriasis, with a sense of prickling and itching; the intoxication produced by it, differs from that resulting from the use of alcoholic drinks, the symptoms being feverishness, increased heat of the surface, palpitation, photopsy, headache, vertigo, increased frequency of the pulse, a peculiar roaring tinnitus, strong desire for active locomotion, with increased sense of strength and agility, exaltation of the intellectual sphere, sense of isolation, followed by a feeling of intense calm and comfort, complete apathy, sleep, odd and rapidly changing dreams, and from which the patient awakes without debility or indisposition of any kind. The leaves of coca, chewed or taken in a weak infusion, stimulate the gastric nerves and greatly facilitate digestion; and are also useful in relieving the sense of fatigue from excessive mental or physical exercise. A drachm of the leaves chewed produces a feeling of comfort in the stomach, and upon repeating the dose a few times, a slight burning sensation is experienced in the mouth and pharynx, with increased thirst, rapid digestion, and a substitution of the coca odor in the stools for that ordinarily present.

More recently, M. Moreno, who made some interesting experiments upon the effects of coca and cocaine, remarks, that coca gives much less arterial tension than coffee, as he has convinced himself with the aid of the sphygmograph. Relatively to its action, M. Weddell has observed: "One of two things, either coca incloses some nutritive principles which directly sustain the forces, or else it simply deceives the hunger, by acting upon the economy as an excitant."

M. Moreno has submitted animals to an insufficient alimentation or to absolute inanition, and in these conditions he has observed that those to whom he administered coca lost more of their weight and died more speedily. He concludes that if coca sustains the forces, that is to say, permits man to forget hunger, it is not, however, as an aliment, and does not succeed in satisfying it. He has carefully studied the special action exerted by this substance upon the nervous system. According to him it determines (1) phenomena which place it with strychnine (tetanic and spontaneous convulsions, and, upon the least excitation of the animals, death); (2) in a small dose, it provokes a remarkable excitation of sensibility, dilitation of the pupil, irregularity of the movements; the animals seem to have lost the coördinating power of their movements. Lastly, in large doses, it causes a diminution, followed by exhaustion, of sensation, without motility being completely abolished, and in all the cases, the pupils remain dilated. Like tea and coffee, coca lessens the elimination of urea, acting thereby indirectly as a food, though not a food in itself. That hunger is staved off by it is probably due to a benumbing effect upon the nervous supply of the stomach.

That the habit of using coca will grow upon one, is illustrated by its effects upon the mountaineers of the Peruvian Andes (see *History*), who employ it to lessen fatigue, and to guard against the pulmonary hemorrhage likely to occur at high altitudes. The habitual coca-chewer acquires a general apathetic state and his step becomes uncertain. Deep purplish circles surround his sunken eyes, his lips tremble, a peculiar blackish colorization is observed at the angles of the mouth, the teeth become green and encrusted, and an intolerably offensive odor is imparted to the breath. Extreme emaciation, with intractable sleeplessness, and anasarca ensue and finally death completes the destruction.

Coca is a remedy for defective innervation, as evidenced by imperfect digestion, even though the appetite remains normal, and when the disorder is associated with occipital and post-cervical pain, vertigo and inability to stand for any length of time (Scudder). It increases the flow of gastric juice, improves the tone of the stomach, and relieves gastric pain. In fact, atonic states of the nervous system and the stomach, are the conditions in which it appears to exert the best effects. *Hysteria* is often cured by it, while, in *chorea*, it may relieve by toning the muscles and increasing nerve power, in this manner giving the patient better control over the muscular movements. From 10 to 15 drops of specific erythroxylon will overcome *insomnia*, caused by a gloomy state of the mind, and sometimes *asthma* is slowly, but permanently, cured by the drug (Locke). In the treatment of the *opium habit* it generally fails.

Coca has been successfully used in *irritative* or *atonic dyspepsia*, *flatulency*, *colic*, *gastralgia*, *enteralgia*, *hypochondria*, *spinal irritation*, *idiopathic convulsions*, *nervous erethism*, and in the *debility* following severe acute affections, *anemia*, *scurvy*, etc. In large doses it has been proposed in *tetanus* and *hydrophobia*, though no trustworthy reports of its efficacy are as yet forthcoming. Prof. Scudder (*Spec. Med.*) suggests that it may be useful in "the early stages of *tuberculosis*, by enabling the person to take the exercise so much needed to burn the imperfect materials in the blood." There is no doubt but that it exerts some control in *wasting diseases* in general. It is reputed useful in *relaxed states of the vocal chords*, and in the granular form of *pharyngitis;* and to allay the thirst accompanying *diabetes*, and the inordinate hunger of the *insane* and *epileptics*. Like tea, coffee, guarana, etc., it is an effectual remedy in *migraine*, or *nervous headache*, and is not without utility in *functional impotence* and *spermatorrhœa*, when due merely to a condition of general debility. Coca has been suggested as an agent to control hunger, thirst, and fatigue for armies during long and forced marches, but, owing to its scarcity, it will probably never be used for this purpose.

Three or 4 drachms of the leaves is a medium dose, whether chewed or used in infusion; of the hydro-alcoholic extract, 10 to 15 grains, in pill form; the dose of specific erythroxylon is from 5 to 30 drops.

Specific Indications and Uses.—Defective innervation with dizziness, impaired digestion, occipital and post-cervical pain, and inability to stand for a length of time; migraine; fatigue; weariness and mental and physical exhaustion; labored and difficult breathing, with normal temperature; inordinate hunger and thirst.

COCAINÆ HYDROCHLORAS (U. S. P.)—COCAINE HYDROCHLORATE.

FORMULA: $C_{17}H_{21}NO_4HCl$. MOLECULAR WEIGHT: 338.71.

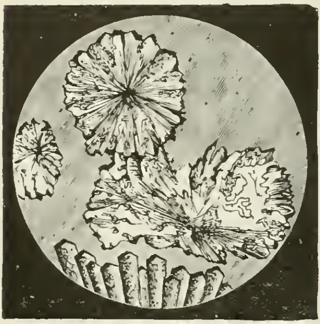
"The hydrochlorate of an alkaloid obtained from Coca"—(*U. S. P.*).

SYNONYMS: *Cocaine hydrochlorate, Cocaine muriate.*

Preparation.—According to the *British Pharmacopœia*, cocaine hydrochlorate may be obtained by dissolving an acidulated alcoholic extract of coca in water, rendering it alkaline by means of sodium carbonate, and agitating it with ether. Evaporate the ethereal solution, purify by means of acidulated water, shake out with sodium carbonate and ether, repeating the above process, decolorize, and, finally, neutralize with hydrochloric acid, and then recrystallize. Cocaine is usually not made by pharmacists.

Description.—The *U. S. P.* describes this salt as "colorless, transparent crystals, or a white, crystalline powder, without odor, of a saline, slightly bitter taste, and producing upon the tongue a tingling sensation followed by numbness of some minutes' duration. Permanent in the air. Soluble at 15° C. (59° F.), in 0.48 part of water, and in 3.5 parts of alcohol; very soluble in boiling water, and in boiling alcohol; also soluble in 2800 parts of ether, or in 17 parts of chloroform. On heating a small quantity of the powdered salt for 20 minutes at a temperature of 100° C. (212° F.), should not suffer any material loss (absence of water of crystallization). The prolonged application of heat to the salt, or to its solution, induces decomposition. At 193° C. (379.4° F.) the salt melts with partial sublimation, forming a light, brownish-yellow liquid. When ignited, it is consumed without leaving a residue"—(*U. S. P.*).

Fig. 78.



Cocaine hydrochlorate. Crystals formed by spontaneous evaporation of a drop of saturated aqueous solution. X 100 diameters.

Tests.—"The salt is neutral to litmus paper. On adding 5 drops of a 5 per cent solution of chromic acid to 5 Cc. of a 2 per cent solution of cocaine hydrochlorate, a yellow precipitate is produced, which redissolves on shaking; on now adding 1 Cc. of hydrochloric acid, a permanent, orange-yellow precipitate will be formed. If a small quantity of the salt be rubbed, with a glass rod, on a dry, white porcelain surface, with an equal bulk of mercurous chloride, and the mixture then breathed upon, it will acquire a dark-gray or grayish-black color. The aqueous solution of the salt yields, with silver nitrate T.S., a white precipitate, insoluble in nitric acid. The addition of sulphuric or nitric acid to the salt, at the ordinary temperature, should develop no color. If 1 drop of a mixture of 1 volume of decinormal potassium permanganate V.S., and 2 volumes of water be added to 5 Cc. of a 2 per cent solution of cocaine hydrochlorate mixed with 3 drops of diluted sulphuric acid, and contained in a small, clean, glass-stoppered vial, the pink tint produced by the permanganate should not entirely disappear within half an hour (absence of cinnamyl-cocaine and some other bases derived from cocoa)"—(*U. S. P*). Maclagan's test is carried out as follows: Dissolve 1 grain (0.064 Gm.) of cocaine in 2 fluid ounces (56.5 Cc.) of water, add 2 drops of aqua ammoniæ (10 per cent), and stir well with a glass rod. When pure, a crystalline precipitate will be produced after a few minutes' stirring. The reliability of this test is doubted by Günther, but is upheld by Paul and Cownley (see *Pharm. Jour. Trans.*, Vol. VII, 1898, and Vol. VIII, 1899).

Action and Toxicology.—Most of the physiological action of cocaine has been determined from experiments upon frogs and the lower warm-blooded animals. Its action upon man has been gleaned principally from its therapeutic employment, and from its action in cases of poisoning by it. There appears to be a difference in the effects produced by the parent drug and its alkaloid, as well as a difference produced by the fresh leaves of coca in its native habitat and the dried product as used in this country. When applied to mucous surfaces, as of the mouth, it first excites the parts, an action which is quickly followed by a sense of numbness, followed shortly by complete local anæsthesia. The same effects are felt upon all mucous surfaces, and are more quickly produced by hypodermatic injection. A sense of coldness after drinking cold water or drawing in the breath, is experienced in the mouth after the benumbing has taken place, similar to that following the application of peppermint or menthol, thus showing that while insensibility to pain may be effected, that the impression to cold is not wholly abolished. To produce a general anæsthesia of the parts quite large doses are requisite. Taken internally in small doses it increases peristaltic movements, while such movements are paralyzed by large amounts. Upon the pharynx, larynx, or nasal fossæ it effects a reduction of sensibility, so that examinations and small operations may be freely permitted. Applied to the conjunctival membranes local anæsthesia is produced though a sense of coldness when an unwarmed instrument is brought in contact with the parts is distinctly felt. The accommodation is impaired, and a partial pupillary dilatation is effected, which may however, be further increased by atropine. The vessels are constringed by it. Internally or hypodermatically administered, or even where absorption has taken place from its application to mucous surfaces, its effects upon the nervous system are very pronounced, and a number of fatal cases have been reported. It has been compared to Indian hemp in its effects upon the brain. Among the symptoms are mental confusion, disordered senses, a glowing sensation throughout the system, and in the beginning a sense of cheerfulness and contentment in some cases, of restlessness, nervous excitation, fear, and terror in others. Vertigo, tinnitus, dilated pupils with impairment of accommodation, headache, and a sense of passing from earth into air, is sometimes experienced. Sleep occasionally follows. The conjunctivæ and skin are pale, the heart's movement accelerated, and respiration quickened. In some cases nausea, vomiting, and eructations occur. When only that stage is reached in which a cheerful inebriation occurs, the insensibility to hunger and power to endure fatigue are striking, and muscular power is undoubtedly increased. Consciousness is usually lost, though this unconscious state may be only apparent, but rather an anæsthetic state. The more pronounced toxic effects vary somewhat. Besides nausea and vomiting, if consciousness still persists, a sensation of great thirst and dryness of the fauces and mouth are complained of. A very rapid, small, thready, and imperceptible pulse characterizes most cases, while in others a slow, feeble pulse and cyanotic state precede slow or arrested breathing. Pain is seldom felt. The breathing is generally slow, shallow, and labored, though at first it is generally quickened. Muscular trembling or even spasms may occur, and if the dose be large they are often severe and with epileptiform movements. Headache, vertigo, and carotid throbbing may be present, and in many cases hallucinations are experienced. Perspiration is sometimes profuse, and in some instances greatly increased diuresis has taken place. Outside of what is oxidized in the body, cocaine is eliminated by the renal organs. Even as small a dose as $\frac{1}{6}$ grain, hypodermatically, has produced great depression and collapse.

To the brain, then, cocaine is a powerful stimulant, first exciting, and in larger doses producing a narcotic state associated with convulsions of an epileptiform character. Upon the spinal cord the sensory portion is thought to be more responsive to cocaine than the motor tract, as toxic doses depress and paralyze the sensory nerves much more readily than the motor filaments. Upon the circulation its effects are less pronounced, arterial pressure being first increased, and if the dose be toxic, the pressure falls. That the heart substance or the intracardiac nerves are directly impressed, increasing the power of contraction, is thought to be the cause of the increased heart action. Striated muscles are not strongly impressed by cocaine, but it exerts a powerful stimulating effect upon the breathing organs, first increasing their action, and finally paralyzing the respiratory centers. While the urine is sometimes increased in quantity, diuresis is not a constant effect of the administration of cocaine, though nearly all agree in its power of decreasing urea-elimination.

Cocaine poisoning is best treated with amyl nitrite, though chloroform and ether (the latter subcutaneously) are useful. Alcohol, morphine, atropine, and chloral are also antidotes in some degree. The treatment is much the same as for poisoning by caffeine.

Medical Uses and Dosage.—Cocaine is not extensively used as an internal remedy. However, it may be given by mouth or hypodermatically, and has been found serviceable in the following conditions. In small doses it has proved a good heart tonic in low *febrile states*, but this use of it has received but little recognition from members of our school. In *angina pectoris*, however, while not so effective as amyl nitrite, nitroglycerin, or lobelia, doses of from $\frac{1}{4}$ to $\frac{1}{3}$ grain 3 or 4 times a day have given good results. When *dropsy* is due to heart debility, the same-sized doses 3 times a day, by their effect of causing increase or rise of blood pressure, stronger heart contractions, and a greater flow of urine, have accomplished cures. It is a remedy for the *vomiting of yellow fever*, *sea sickness*, and of *pregnancy*. In the latter condition it has also been applied by way of the rectum, or directly as an ointment to the os uteri. Testimony may be had for and against its use in sea sickness. As a preventative and as a remedy therefor, Monassein (*Med. News*, Vol. 47, p. 320), used a solution of cocaine hydrochlorate 0.15 part, alcohol a sufficiency, and distilled water 150 parts. A drachm dose of this was administered on embarking, and continued every 2 or 3 hours until no further danger of sickness seemed probable. In *sick headache* and *neuralgia* from $\frac{1}{4}$ to $\frac{1}{3}$ grain may be injected near the affected parts. The same may be resorted to in *sciatica*. The gloom of temporary *hypochondria* may be dispelled by small doses of cocaine, and fatigue due to loss of sleep may also be relieved by it. Its action in confirmed mental disorders, however, is deleterious, and it has failed to become a remedy for *neurasthenia*, *melancholia*, etc., as it was once hoped would prove to be the case. Were it not for the fact that almost toxic doses are required, it would be of value in such gastric disorders as *neuralgia*, *ulceration*, or *carcinoma* of that organ. As a remedy in the treatment of *alcoholism* and of the *opium habit* it has nothing to commend it, as a cocaine habit, as pernicious as those it is sought to cure, is extremely liable to become established.

Cocaine is locally used in a great variety of *painful affections* of the mucous tracts. When applied to the parts they become pale on account of the anemia resulting from the constriction of the vessels produced. It is thus valuable to arrest or to palliate *inflammation of the nasal membranes*, *fauces*, *pharynx*, and *larynx*. In acute *tonsilitis* a 2 to 4 per cent solution painted upon the parts relieves the pain and reduces the swelling, while for chronic cases a 6 per cent solution in a vehicle of one-third water and two-thirds glycerin is effective. These solutions should be painted upon the parts with a pencil twice a day. In *tubercular troubles* of the upper part of the throat, such as tenderness and ulceration, and in the irritable throat of *phthisis*, *cancer*, or *syphilis*, preventing the patient from taking food, a strong solution (6 per cent), applied to the parts 3 or 4 times a day gives marked relief, and enables the patient to take nourishment with comfort. Early applied it will arrest *coryza*, and applied in solution or suppository it is exceedingly effectual in the paroxysms of *hay fever*. Or it may be applied upon cotton wool or insufflated with some inert powder. It not only allays the pain and irritability, but it has a tendency to enlarge the nasal fossæ through its constringing agency. It alleviates the painful condition of *fissures*, *ulcers*, etc., of the buccal membranes. *Epistaxis* may be arrested with cocaine locally applied. The solution is palliative only in *whooping-cough*, and may be used to allow the hydrophobic patient to swallow water and other fluids. Cocaine reduces *phimosis* and *paraphimosis*, and applied to the urethra or rectum controls *chordee*, and in enema or suppository is useful in allaying *cystic irritability* when due to an enlarged prostate, and will control *tenesmic pain* in the bladder or rectum. *Dysentery* is relieved by it locally applied, and in strong solution, suppository, or ointment, it mitigates the pain of *rectal cancer*. *Urethral spasms* are relaxed by it, and it relieves in the acute stage of *gonorrhœa*. It may be applied in itching and burning conditions of the vagina and anus. Applied to the vaginal orifice in cases of *vaginismus*, coitus may be perfectly and painlessly accomplished. A 2 per cent solution is valuable to assuage the pain of *burns* and *scalds*, and is of service in *wounds* of delicate parts like the eye, to subdue the exalted sensibility so that the parts may be properly and painlessly dressed. Locally applied or subcutaneously injected, it subdues the pain incident to *insect stings* and *bites.* In *earache* from cold a few drops of equal parts of glycerin and a 2 per cent solution of cocaine arrests the pain. The same procedure may assuage the pain of *dental caries.*

Cocaine serves a valuable purpose in allaying irritability of parts so that examinations of delicate structures may be facilitated. It renders easy the use of the aural speculum, and instruments necessary in examination or operation upon the auditory canal, catheterization of the Eustachian tube, the introduction of the rhinoscope, laryngoscope, and lavage tubes, examination of the male or female urethra, and the introduction of catheters, bougies, or lithotrite, and the rectal speculum and dilators are all facilitated by first treating the parts with cocaine.

The discovery of the anæsthetic properties of cocaine revolutionized the practice of *minor surgical operations,* and especially upon the eye and kindred structures. As a local anæsthetic the acetate of cocaine was used as early as 1868, by Thomas Moreno y Maiz (*Paris Thesis,* p. 77); but the importance of this use of the drug did not seem to be fully appreciated by him. In 1880, Von Anrep called attention to the probable utility of cocaine as a local anæsthetic, but it was reserved for Koller, a student at Vienna, and now a practitioner of New York City, to perfect the knowledge of the anæsthetic uses of the drug and proclaim it to the world, and its success and popularity has been phenomenal.

In *ophthalmic surgery,* the solution generally employed is that of 4 per cent strength, though some use as high as an 8 to 10 per cent solution, but the latter has no particular advantage over the former. It should preferably be applied with a dropper at intervals of 3 or 4 minutes until 3 or 4 instillations have been made. Cocaine discs ($\frac{1}{25}$ grain) of gelatin, paper, linen, or cotton, are all undesirable and likely to become moldy. Not only does cocaine constringe the vessels of the part and produce local anæsthesia, but in the case of the eye it dilates the pupil and increases the power of absorption of atropine, homatropine, and eserine. A false astigmatism may be produced by its use on account of an irregular action set up in the ciliary muscles. The long-continued use of cocaine upon the structures of the eye is very deleterious, and following the temporary effects, inflammation of a grave character, ulceration, opacity, or exfoliation of the cornea having been produced by it. This is undoubtedly due to its constringing action, lessening the blood supply and consequently lowering the vitality of the tissues. Slow healing after operations has been attributed to the use of cocaine as an anæsthetic. In spite of its occasional bad results, however, it has become a most important agent with the ophthalmic surgeon. It is injected behind the eye for the removal of that organ, and should also be injected when operations upon the lachrymal sacs, incisions into the lachrymal canals, or operations upon the lids are to be performed. Its local use allays *photophobia,* and carried to anæsthesia by instillation it may be employed to remove *foreign bodies* from the eye, and in *operative measures* for *trachoma, pinguecula, pterygium,* cauterization of *corneal ulcers, strabismus, tenotomy, anterior staphyloma, iridectomy, cataract, prolapse of the iris,* the removal of *conjunctival* and *corneal growths,* and in other operations within or without the globe. As a rule it is contraindicated in glaucoma, but *hypopyon* is said to have been reduced in size by a 2 per cent solution.

In the nasal, pharyngeal, and laryngeal cavities it is employed to produce anæsthesia preparatory to the removal of *tumors, polypi,* and other *growths,* and to enlarge the parts in *nasal stenosis,* and to reduce *hypertrophied states of the mucous tract.* Operations for *harelip* and *cleft palate* have been performed under its use, while amputation of the *uvula* and *tonsils* are painlessly effected when the parts are well cocainized. Operations for *hernia* and *staphylorraphy* have been successfully performed under cocaine anæsthesia. It should be used in opening *mammary abscesses, felons, suppurating bubos,* and for the removal of *ingrown nails.* While cocaine has been applied to sensitive teeth to facilitate their excavation, it is not considered universally applicable, and is not now very much used for that purpose. It is, however, very valuable, but not without occasional dangerous results, as an anæsthetic for the *extraction of teeth,* or of *alveolar spiculæ.* The hydrochlorate is generally used, though some contend that better results are obtainable from the citrate. Of the 2 per cent solution 4 or 5 minims may be injected into the gum close to the tooth, and allowed to remain about 8 minutes before extraction of the tooth is attempted. If it does not wholly control the pain it greatly lessens it, and especially obtunds the gum so that no pain whatever is felt in applying the forceps unless the gum be greatly inflamed.

Itching skin diseases, such as *eczema*, *herpes*, *erysipelas*, *scabies*, and the like are relieved by a 5 per cent petrolatum ointment of cocaine. The maxium dose of cocaine hydroclorate should not be more than ¾, or at most, 1 grain, though some have put the limit at 2 grains, and the daily amount at 6 grains.

Specific Indications and Uses.—To produce local anæsthesia upon painful parts, or to facilitate examinations and minor operations upon sensitive tissues.

Other Salts of Cocaine and Related Drugs.—Cocaine Benzoate. This salt forms needles which crystallize with difficulty. It is prepared by combining aqueous solutions of cocaine (5 parts) and benzoic acid (2 parts). Water freely dissolves it. *Benzoyl ecgonine* has been sold for it. The latter is formed by the action of water and heat upon cocaine.

Cocaine Nitrate.—Readily soluble, large crystals, devoid of color. It has been recommended as an agent to use conjointly with silver nitrate to lessen the pain caused by using the latter as a caustic. Cocaine hydrochlorate, however, can not be used with silver nitrate, owing to the formation of insoluble silver chloride.

Cocaine Phenate.—A viscid, yellow mass soluble in alcohol, but not in water. On account of its being less readily absorbed, Von Oefele has proposed it for use in place of cocaine hydrochlorate as a local anæsthetic on mucous surfaces.

Cocaine Borate contains 68.7 per cent of base. A white crystalline powder, soluble in alcohol, which solution is more permanent than that of cocaine hydrochlorate (Merck's *Index*. 1896).

Cocaine Citrate forms a white crystalline powder, hygroscopic and soluble in water. It contains 75.7 per cent of cocaine. It is chiefly employed in dental practice. The dose is from 1/20 to 1 grain.

Cocaine Hydrobromate ($C_{17}H_{21}NO_4.HBr$).—This salt occurs as small, white crystals (see Fig. 77). It is soluble in water, and is used in the same sized doses and for the same purposes as cocaine hydrochlorate.

Eucaine—Two preparations, viz., *Eucaine* "*A*" and *Eucaine* "*B*", have recently been placed upon the market as substitutes for cocaine.

Eucaine "A" (*n-methyl-benzoyltetramethyl-γ-oxypiperidincarbonic acid-methylester*) is a white, crystalline powder, neutral, and soluble in 10 parts of water. It is claimed that it is less toxic than cocaine, though the maxium dose (¾ grain) of the latter should not be exceeded. The solution does not, it is asserted, decompose, and may be sterilized without injury to the preparation. Claimed of less value for ocular work than the Eucaine "B", on account of the irritation and hyperemia produced. The following strengths of solutions are directed: Diseases of nose, throat, and ear, 2 to 8 per cent; dentistry, 4 to 9 per cent; minor surgical operations, 5 per cent; solutions of greater than 9 per cent strength deposit crystals of the drug.

Eucaine "B" (*benzoylvinyldiacetonalkamine*) is crystalline, white, neutral, and soluble in 27 to 28 parts of water; hot water dissolves it more readily. Solutions non-decomposable and not affected by sterilization. Claimed to be slightly antibacterial, less toxic than Eucaine "A", and 5 times less poisonous than cocaine; does not cause mydriasis and corneal, or accommodation disturbances (as cloudiness of the cornea), but little vascular injection, etc. The strength of solutions recommended are: For ocular use, 2 per cent, about 4-drop instillations shortly before operations, prolonged and repeated applications producing untoward effects; infiltration anæsthesia, 1/10 to 1 per cent; genito-urinary disorders, ½ to 2 per cent.

Though conceded to be less toxic than cocaine, eucaine is reported to have produced intoxication through the application of 4 per cent solutions to the throat. F. B. Kellogg, M. D., Tacoma, Wash. (*Pacific Coast Journal of Homœopathy*, April, 1897), reports such a case exhibiting "spasmodic muscular contractions of the arms and legs;" "the heart's action was also affected, the pulse becoming rapid and small." Dr. Kellogg regards eucaine as too irritating for ordinary application to the eye. The greatest advantage, he concedes, is its value when desirable to avoid pupillary dilatation, as in the removal of *foreign bodies* (the iris acting as a back ground in light-colored eyes, thus aiding in the detection of the particle), and for use upon the eyes of the elderly with "*glaucomatous tendency.*" It gives one advantage in *nasal operations*, in that, by not causing shrinkage, it allows the operator to ensnare *posterior hypertrophies of the inferior turbinated bone*, being useful as well in *anterior hypertrophies.* On the other hand, cocaine produces a marked shrinkage of the tissues. As yet the exact therapeutical position of the agent can not be stated.

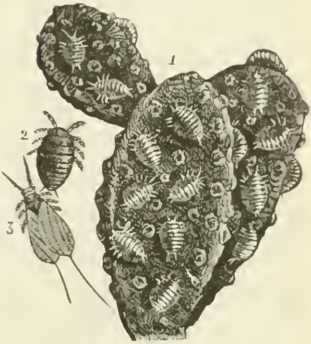
Tropa-cocaine. Tropa-cocaine, an alkaloid isolated by Giesel from the narrow-leaved variety of *Erythroxylon Coca*, Lamarck, grown in Java, is, according to Liebermann, *benzoyl-pseudotropeine* ($C_8H_{14}NO.C_6H_5.CO$) (see *Cocaine*). It is also prepared synthetically. The hydrochlorate is principally used. It occurs in colorless crystals, soluble in water, the solution being (claimed) more stable than the corresponding solution of cocaine hydrochlorate. It is reputed a local anæsthetic, differing in action from cocaine and other local anæsthetics in not producing irritation, hyperemia (occasionally slight and transient hyperemia), or ischemia; furthermore it is said to be less toxic and depressing to the cardiac ganglia and to the heart. But little or no mydriasis results from its use. Anæsthesia is quickly produced, according to Silex, *tenotomy* having been painlessly performed in less than ½ minute after the application of a 3 per cent solution of the hydrochlorate. The usual method of exhibition is the 3 per cent solution of tropa-cocaine, in a 0.6 per cent sodium chloride solution, 1 or 2 drops being instilled into the eye.

COCCUS (U. S. P.)—COCHINEAL.

"The dried female of *Coccus cacti*, Linné"—(*U. S. P.*).

"*Class:* Insecta. *Order:* Hemiptera"—(*U. S. P.*).

Fig. 79.



Coccus cacti.
1. Cochineal insects feeding.
2. Female Insect.
3. Male Insect.

Source.—The cochineal insect, Coccus cacti, belongs to the class Insecta, order Hemiptera; the general characters are: Tarsi, with one joint, terminated by a single hook. The male is destitute of a rostrum, and has two wings covering the body horizontally; the abdomen is terminated by 2 setæ. The female is apterous, and furnished with a rostrum. The antennæ are of 11 joints, filiform, and setaceous. The males are very small, with antennæ shorter than the body, which is elongated, deep-red, and terminated by 2 long, diverging setæ. The wings are beautifully snow-white, large, and crossed above the abdomen. The females are nearly twice as large as the males, wingless, bluish-red, covered with a white farina, have the antennæ short, and the body convex and flattened below, with short feet.

History.—The Cochineal insects inhabit Mexico, and other parts of tropical America, where they feed on the Opuntia and Cactus families of plants. They are also cultivated extensively in the Canary Islands, and to some extent in the West Indies, and have been introduced into southern Spain, though their cultivation in the latter country is said to have been unprofitable. They are collected at various seasons. The best are the product of the first collection, which consists of the impregnated females; the males not being gathered. Those killed by the heat of a stove are said to be superior to those destroyed by boiling water and sun-dried.

The insects are protected during the rainy season by coverings placed over the cactus plants on which they are feeding. After pleasant weather has returned they are taken out and planted or sown on the different species of Opuntia, particularly the *Opuntia cochinillifera* of Miller, known to the Mexican natives as *nopal*. The male insect, which is very rapid in its movements, flies to the female, and, after the act of fecundation, the female attaches itself to the plant and remains stationary, rapidly enlarging from the development of an immense number of eggs within the body, and, in this distorted condition is knocked off the plant with feathers and dull knives, and either dipped into hot water and afterwards sun-dried, or killed by being placed in heated ovens. A few are left, however, to deposit their eggs, shortly after which they die. The eggs, hatching in the sun, give an innumerable supply of young insects, which at once distribute themselves over the plant and begin feeding. In this manner 3 crops are gathered yearly from the *nopal plantations*. For a full and instructive account of the cultivation of cochineal in Central America, see *Amer. Jour. Pharm.*, 1873, p. 30.

Description.—The *U. S. P.* thus describes cochineal: "About 5 Mm. ($\frac{1}{5}$ inch) long; of a purplish-gray or purplish-black color; somewhat oblong and angular in outline; flat or concave beneath; convex above; transversely wrinkled; easily pulverizable, yielding a dark-red powder. Odor faint; taste slightly bitterish. Cochineal contains a red coloring matter soluble in water, alcohol, or water of ammonia, slightly soluble in ether, insoluble in fixed and volatile oils. On macerating cochineal in water it swells up, but no insoluble powder should be separated. When completely incinerated, cochineal should leave not more than 5 per cent of ash"—(*U. S. P.*). As met in commerce, cochineal is sometimes covered with a white bloom, which, if not due to adulteration, consists of a wax-like body (see below). When properly kept it is not liable to deteriorate. There are two varieties, *silver grains* (*silver*, or *Honduras cochineal*) and *black grains* (*zaccatilla* *cochineal*). The silver cochineal, of a reddish ash-color, is said to be procured by destroying the female insect previous to laying its eggs, and is the most esteemed; the black cochineal, of nearly a black color. is obtained by killing the female after the eggs have been laid (*Amer. Jour. Pharm.*, Vol. XVIII, p. 47). According to other statements the silver grains are the product of oven-killed insects, or those allowed to perish by sun-heat, while the black grains are produced by immersion of the live insect in boiling water. There are also inferior grades, consisting chiefly of uncultivated young insects, called *granilla* (*grana sylvestra*). Dr. Jas. Stark, in 1855, directed attention to a commercial form, called "cake cochineal," imported from Cordova, Argentine Republic. However, it possessed only $\frac{1}{6}$ of the coloring strength of ordinary cochineal.

Chemical Composition.—Cochineal imparts a violet-red tinge to the saliva. It was first analyzed by Pelletier and Caventou, in 1818, and according to Hager (*Handbuch*, 1886), was found by subsequent analyses to contain moisture (about 6 per cent), fatty matter (15 to 18 per cent), red coloring matter (40 to 45 per cent), ash (3.5 to 5 per cent), and insoluble matter (7 to 11 per cent). The red coloring matter, first investigated closely by Warren de la Rue, in 1847, has been called *carminic acid*, and, following the later researches of Grabowski and Hlasiwetz, was believed to be a glucosid capable of being resolved by the action of diluted sulphuric acid, into *carmine-red* and sugar. Von Miller and Rohde (1893), however, established the non-glucosidal character of this substance. Pure carminic acid, by treatment with boiling dilute sulphuric acid, remained on the whole unaffected, although partial decomposition took place, yielding formic acid and a strongly reducing substance of unknown composition (*Amer. Jour. Pharm.*, 1894; from *Berichte*, 1893). According to Liebermann and Voswinckel (1897), carminic acid yields upon oxidation *cochenillic acid* ($C_{10}H_8O_7$) and *coccinic acid* ($C_9H_8O_5$) which are (tri- and dicarboxyl) derivatives of *meta kresol* ($C_6H_4.CH_3.OH$). The exact structural formula of carminic acid is not exactly established.

Carminic acid (*carmine-red*) usually occurs as a brown-purple body, but may be obtained in large, garnet-red crystals by treating good commercial cochineal with 5 times its weight of water, filtering, agitating with 20 times its weight of glacial acetic acid, filtering again, and allowing the solution to crystallize over sulphuric acid (v. Muller and Rohde). Carminic acid is soluble in alkalies, warm water, and alcohol; not soluble in oils and fats; aluminum salts precipitate it in the form of a purple-lake. Will and Leymann obtained from 5 kilograms of the silver-gray variety of cochineal, 400 to 500 grammes of pure carmine-red. These investigators also obtained two bromine compounds ($C_{10}H_4Br_4O_3$ and $C_{11}H_5Br_3O_4$), which are mainly of theoretical interest (see *Amer. Jour. Pharm.*, 1886, p. 91). The whitish material covering the insect was investigated by Liebermann (1885), who found it to be a peculiar wax, soluble in benzol, which he named *coccerin*, the constituents of which are *coccerylic acid* ($C_{31}H_{62}O_3$), melting at about 92° C. (197.6° F.), and *cocceryl alcohol* ($C_{30}H_{62}O_2$), melting at about 104° C. (239.2° F.). Besides, he found in cochineal *myristin* (1.5 to 2 per cent), and liquid fatty oil (4 to 6 per cent). Liebermann observed 1 to 2 per cent of coccerin in the silver variety, 0.5 to 1 per cent in the black variety, while from *granilla* (the inferior kind) he obtained 4.2 per cent (*Amer. Jour. Pharm.*, 1886).

Adulterations.—*Carmine* has been adulterated largely with starch, vermilion, dichromate of lead, talcum, etc. These additions, however, may be readily detected by dissolving the cochineal coloring matter with aqua ammoniæ, and examining the residue for the substances named. E. Donath, in *Chem. Ztg.*, 1891, reports on a sample of commercial "ordinary" carmine, which consisted of lead oxide and alumina lakes of *eosine*, and contained much lead sulphate, Another specimen ("carmin antik") of good appearance was the barium compound of *red corallin* (related to rosolic acid and rosanilin), leaving, upon ignition, 75 per cent of barium carbonate (*Amer. Jour. Pharm.*).

Cochineal, especially in powder form, has been adulterated with French chalks, plumbago, soapstone, carbonate of lead, manganese dioxide, barium and iron salts, etc., to increase the weight, and the grains have even been imitated. The *U. S. P.*, as stated before, fixes the upper limit of ash at 5 per cent. We, however, have found the majority of commercial specimens (both powdered and whole cochineal) to exceed this limit by far, the ash often running as high as 25 and 32 per cent. A species of Coccus (*Coccus ilicis*, Fabricius feeding upon a Mediterranean oak (*Quercus coccifera*, Linné), has been occasionally met as an adulteration. It is known as *chermes*, *kermes*, or *alkermes*, and, when dried in the sun after having been treated with acetic acid, becomes colored a brown-red, and yields a carmine powder, producing with tin salt ($SnCl_2 + 2H_2O$) a bright scarlet-red color, similar to that derived from true coccus. They are nearly spherical and quite smooth.

Action, Medical Uses, and Dosage.—Anodyne and antispasmodic. Formerly used in *whooping-cough* and *neuralgic affections*. Also used to color tinctures and ointments, imparting a beautiful carmine hue. Webster (*Dynam. Therap.*, p. 431) declares that coccus specifically influences the entire urinary tract and directs small doses in *renal colic, copious voidings of clear, limpid urine*, due to renal capillary relaxation, and in *vesical tenesmus* and *urinal retention*. He suggests that 10 to 15 drops of mother tincture be added to 4 fluid ounces of water, and a teaspoonful administered every 2 hours. Dose, from 5 to 10 grains, 3 or 4 times a day.

Specific Indications and Uses.—"Colica renalis, with dark-colored urine and pain extending down ureters to bladder" (Watkins' *Comp. of Ec. Med.*).

Derivative.—CARMINE (derived from cochineal) is not a definite principle, but contains a mixture of nitrogenous compounds, ash, wax, and coloring matter to the extent of as high as 60 per cent. It may be prepared by precipitating a filtered cochineal decoction with bitartrate of potassium or alum, and collecting and drying the precipitate at about 30° C. (86° F.).

RED INK.—Red ink may be made as follows: Take of cochineal in powder, 160 grains; carbonate of potassium, 320 grains; distilled water, 8 fluid ounces; mix together and boil; then add of alum, 80 grains; bitartrate of potassium, 2 ounces; let them stand for 24 hours, filter, and add ½ ounce of powdered gum Arabic.

CODEINA (U. S. P.)—CODEINE.

FORMULA: $C_{18}H_{21}NO_3 + H_2O$. MOLECULAR WEIGHT: 316.31.

SYNONYMS: *Codeinum*, *Codeia*, *Methyl morphine*.

"An alkaloid obtained from opium"—(*U. S. P.*).

Source and History.—Codeine, one of the alkaloidal constituents of opium, exists therein in the form of *meconate*. It was discovered in 1832, by Robiquet, and its close chemical relation to morphine ($C_{17}H_{19}NO_3$), was pointed out by Matthiessen and Wright, in 1869, who demonstrated that *codeine* ($C_{18}H_{21}NO_3$) must be considered as *methyl morphine*. In 1881, Grimaux succeeded in preparing codeine synthetically from morphine by heating together equimolecular quantities of methyl iodide (CH_3I), morphine and sodium hydrate in alcoholic solution. O. Hesse also effected the synthesis of codeine from morphine independently of Grimaux's discovery, and further methods have since been elaborated by A. Knoll and others.

Preparation.—Directions for preparing codeine from opium are given by Hager (*Handbuch*, 1886) According to this process the hydrochlorates of morphine and codeine, after being obtained together, are decomposed by caustic potash solution, whereby codeine is precipitated, while morphine remains in solution. In the process of Robiquet and Anderson these alkaloids are separated by means of aqua ammoniæ which precipitates the greater part of the morphine, while codeine hydrochlorate remains dissolved, crystallizing upon concentration of the liquid. From this salt the codeine is liberated by caustic potash, and purified (see also *Codeina* under *Opium*).

Description.—"White, or nearly translucent, orthorhombic prisms, or octohedral crystals, odorless, having a faintly bitter taste, and slightly efflorescent in warm air. Soluble at 15° C. (59° F.), in 80 parts of water and in 3 parts of alcohol. In boiling water codeine melts into oily drops which dissolve in 17 parts of the water. It is very soluble in boiling alcohol; also soluble in 30 parts of ether, and in 2 parts of chloroform. At 100° C. (212° F.), codeine loses its water of crystallization (5.67 per cent); at 155° C. (311° F.) it melts, forming a colorless liquid; and when ignited it is consumed without leaving a residue. Codeine is neutral to litmus paper"—(*U. S. P.*)

Codeine, the reverse of morphine, is almost insoluble in concentrated solutions of caustic soda or potassa. In ammonia water codeine is soluble in the proportion of about 1 to 85, and morphine 1 to 117. Codeine is also soluble in carbon disulphide, and methylic and amylic alcohol. Recently, M. L. Fouquet suggested a method of separating codeine from morphine, based on the difference of solubility of these alkaloids in *anisol* (the methyl ether of phenol [$C_6H_5OCH_3$], boiling point 150° C. (302° F.), and sp. g. 0.991), morphine being insoluble and codeine soluble in this liquid at ordinary temperature (*Amer. Jour. Pharm.*, 1897, p. 158). From absolute ether, codeine crystallizes without water of crystallization. With acids it forms crystallizable salts, nearly insoluble in ether. Codeine is so strong a base that it displaces morphine from its salts.

Tests.—"If 0.1 Gm. of codeine be dissolved in 6 Cc. of cold, concentrated sulphuric acid (free from nitrose), the resulting liquid should be colorless. If about 2 Cc. of this solution be poured into a small porcelain capsule, and 1 drop of highly diluted nitric acid (made by adding 1 drop of nitric acid to 200 Cc. of water) added, a bluish-red tint gradually changing to pale blue will be developed. Another portion of the same solution, of about 2 Cc., gently warmed and mixed with 1 drop of a mixture of 1 volume of ferric chloride T.S. and 19 volumes of water, likewise assumes a bluish or blue tint (difference from morphine). On adding to 5 Cc. of an aqueous solution of codeine (1 in 100), 10 drops of bromine water, and shaking so as to redissolve the precipitate formed, the liquid will gradually develop a light claret-red tint. This tint may be developed at once by the addition of ammonia water. On sprinkling 0.05 Gm. of codeine upon 2 Cc. of nitric acid (specific gravity 1.200), the crystals will turn red, but the acid, even when warmed, will acquire only a yellow color (difference from and absence of morphine)"—(*U. S. P.*).

Unlike morphine, codeine does not liberate iodine from iodic acid. *Fröhde's Reagent* (a solution of 1 gram of sodium molybdate in 1 liter of water), dissolves codeine with a dirty-green color which soon turns blue, fading to yellow only after many hours. A characteristic test for codeine is that proposed by L. Raby, which, according to the *Amer. Jour. Pharm.*, 1886, p. 495 (from *Jour. Pharm. Chim.*, 1884), is executed as follows: Rub a small quantity of codeine with 2 drops of a solution of sodium hypochlorite on a watch crystal, and add 4 drops of concentrated sulphuric acid. A beautiful sky-blue color is then produced. No other alkaloid is known to produce the same reaction.

Action, Medical Uses, and Dosage.—Codeine acts specifically upon the vagus. When pure it is probable that large doses of it may be taken without decided physiological effects. However, that is denied by some investigators. That the commercial product varies greatly is generally accepted, and by the majority of observers the effects of commercial codeine are mainly attributed to its impurities, the adherent alkaloidal bases. Owing to its great variability the smaller amounts should always be given as a beginning dose and the drug increased until its desired action is obtained. While as high as 8 grains have been given in 24 hours without pronounced effects, 4 grains have, in another instance, caused almost fatal results (Myrtle, *Br. Med. Jour.*, 1874). Among the effects of codeine are the following: Small doses of $\frac{1}{2}$ grain seldom occasion constipation, nausea, or vomiting, but produce a calmative effect, followed by a peaceful and refreshing slumber, without producing skin eruptions or perspiration. Large doses, from $1\frac{1}{2}$ to 2 grains, produce first a sense of exhilaration, quickly followed by depression with nausea, vomiting, anxiety, giddiness, tremor, dullness of intellect, cerebral fullness and heaviness, and cold, pale, and moist skin. The pulse is slightly quickened, the pupils somewhat contracted, and delirious wakefulness is added to the unpleasantness.

Codeine in $\frac{1}{2}$-grain doses, increasing as indicated, has been used in the treatment of the *opium habit*—being a substitute for the latter agent and the morphine salts. It was introduced into medicine chiefly on account of its beneficial effects in *diabetes*, both simple and saccharine. Much evidence has been produced to show that it lessens both the amount of urine secreted and the quantity of glucose produced. However, it has not by any means proved of universal application in these disorders. Large quantities of codeine are used in France as a calmative to take the place of opium, to which it is inferior in power, and over which it has the advantage of being, in ordinary doses, practically non-constipating. It is a favorite with some as a calmative in *restlessness* and *insomnia*, and as a quieting agent in *cough*, and particularly that of *phthisis*, being employed where opium is not well tolerated, and is regarded as superior to the latter from the fact that it does not irritate the stomach, nor disorder digestion. In doses of from ½ to 1 grain, it is anodyne and antispasmodic, without acting as a soporific. For this purpose it has been employed in *painful abdominal disorders*, as *enteralgia*, and in *painful diseases of the genito-urinary tract*, in *pain* due to *structural disease* or to *obstructions*, and as a remedy for *neuralgic*, *rheumatic*, and various *paroxysmal pains*. It is especially adapted for the relief of mild *pain from ovarian irritation*.

Although inferior to morphine for allaying pain, and necessarily given in larger doses, in many respects it is superior to it in its effects, never causing heavy agitated sleep, perspirations, eruptions of the skin, obstinate constipation, retching, vomiting, nor disturbance of digestion when given in the smaller doses. Its earlier application was in *nervous diseases of the stomach*, in the stubborn and harrassing *coughs of bronchitis* and *consumption*, in violent *rheumatic* and *gouty pains*, and in the *pains of cancer*.

The beginning dose of codeine is ⅓ grain, increased as indicated, and may be administered in powder, pill, or syrupy mixtures. The sulphate and hydrochlorate are given for similar purposes and in like doses, while the phosphate, in doses of about ¼ to ½ grain, may be given hypodermatically.

Specific Indications and Uses.—A calmative where opium is apparently indicated, but not well tolerated. Insomnia, and particularly when sleep is prevented by cough; cough, constant and irritating; abdominal pain; diabetes.

Related Salt.—CODEINE PHOSPHATE is official in the *German Pharmacopœia*, which demands that this product when heated to 100° C., should lose about 8 per cent of its weight. The salt forms white needles of bitter taste, quite soluble in water, less so in alcohol. It is obtained by neutralizing codeine with phosphoric acid and crystallizing from water, or precipitating the solution with alcohol. Prof. E. Schmidt has demonstrated that under these conditions a salt of the composition $C_{18}H_{21}NO_3.H_3PO_4+2H_2O$ results, while, when crystallized from hot dilute alcohol its composition is represented by the formula $2(C_{18}H_{21}NO_3.H_3PO_4)+H_2O$ (*Amer. Jour. Pharm.*, 1890, p. 445).

Derivatives.—APOCODEINE ($C_{18}H_{19}NO_2$). Matthiessen and Wright obtained this body by heating codeine hydrochlorate with zinc chloride in excess to a temperature of 180° C. (356° F). More recently, W. Göhlich produced the same substance by acting with alcoholic caustic potash under pressure upon *chlorocodid* ($C_{18}H_{20}ClNO_2$), a chlorine substitution product of codeine (see *Archiv. der Pharm.*, 1893, pp. 235-290). Apocodeine is an amorphous mass, soluble in alcohol, chloroform, and ether, and acts as an emetic and expectorant like apomorphine, being more stable than the latter body. A perfectly neutral solution may be used hypodermatically. The dose is about ⅛ grain. Large doses may produce death, preceded by emesis and coma.

PSEUDO-CODEINE ($C_{18}H_{21}NO_3+H_2O$).—Merck, in 1890, obtained this body as a by-product in the manufacture of apocodeine, and proved it to be an isomer of codeine. W. Göhlich (*Archiv. der Pharm.*, 1893) demonstrated its being identical with a crystallizable body which he obtained by heating codeine with a mixture of an equal volume of sulphuric acid and water. The amorphous form of this substance Göhlich found to be identical with the "amorphous codeine" of Armstrong, the melting point of these bodies being 180° C. (356° F.). Kobert states that the physiological effects of pseudo-codeine are similar to those of codeine.

COLCHICUM.—COLCHICUM.

The corm and seeds of *Colchicum autumnale*, Linné.

Nat. Ord.—Liliaceæ.

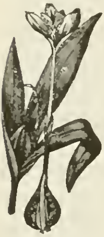
COMMON NAME: *Meadow saffron.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 287.

Botanical Source.—This plant has a large, ovate, solid, fleshy corm (tuber, according to some authors). The leaves are dark-green, very smooth, obtuse, above a foot long, 1½ inches broad, keeled, and produced in the spring along with the capsules. The flowers are several, radical, leafless, and bright purple, with a long, white tube appearing in the autumn without the leaves. The capsules 3 and distinct, though forming together a single, oblong, elliptical fruit, with intermediate fissures. The seeds are whitish and polished (L.).

History.—Colchicum grows in meadows and low, rich soils in many parts of Europe, and is common to England. The herb is annual, but the bulb is annual or perennial, according to the manner in which the plant is propagated, which may be from the seed, by the formation of a single mature bulb from a parent bulb, or by the separation of several immature bulbs from the parent. A brief reference to its mode of development may be useful: "In June or July a new bulb about the size of a grain of wheat is formed at the lower end of the old one, in close approximation with its radicles; this little bulb increases with rapidity, and at the same time sends up a leafless flower-stem. Toward the first of October a lilac, or pale-purple, flower springs from the ground, the germen remaining at the base of the corolla tube, but the leaves do not appear until early in the ensuing spring, at which time the germen, consisting of 3 many-seeded capsules, is elevated, and the seeds are matured during midsummer, after which the plant speedily withers. While the flower is rising in the autumn, the bulb is very small, but in the winter it grows rapidly, being in April as large as a chestnut, and attaining its greatest size, about that of a small apricot, in July. It is now a year old, and the herb having matured its seed, is withering away, but a new bulb appears at the lower end, close to its junction with the radicles or root proper, and passes through a similar succession of changes; while the old parent bulb gradually becomes more spongy and watery, but retains its size until the following April, the second spring of its own existence, when it quickly decays" (C.).

Fig. 80.



Colchicum autumnale.

Description.—Colchici Radix (*U. S. P.*), *Colchicum root.* "About 25 Mm. (1 inch) long, ovoid, flattish, and with a groove on one side; externally brownish and wrinkled; internally white and solid; often in transverse slices, reniform in shape, and, breaking with a short, mealy fracture; inodorous; taste sweetish, bitter, and somewhat acrid"—(*U. S. P.*).

Colchici Semen (*U. S. P.*), *Colchicum seed.*—"Subglobular, about 2 Mm. ($\frac{1}{12}$ inch) thick, very slightly pointed at the hilum; reddish-brown, finely pitted, internally whitish; very hard and tough; inodorous; taste bitter and somewhat acrid"—(*U. S. P.*).

The seeds and the bulb are the official parts of the plant. The bulbs are usually collected about the beginning of July, but are said to attain their greatest perfection while the plant is flowering, or just after blossoming, at which time colchicum should be gathered for medicinal use. The odor is hircine (stinking like a goat), and the taste bitter, acrid, and nauseous. In drying, the bulb is usually cut into thin transverse slices, having first been stripped of its external dark brownish-black membranous tegument, and is dried quickly; sometimes it is dried entire. Good colchicum bulbs, when dried, are capable of changing their color to blue if softened with distilled vinegar, and then touched with tincture of guaiacum. Stained or mouldy bulbs should be rejected. Their virtues are imparted to alcohol, vinegar, or wine. The acetic tincture is often preferred to the vinous, as it is not so liable to change or decomposition. Acids render the vinous tincture drastic, while alkalies render its operation milder. The decoction of the fresh bulb forms, with a solution of iodine, a deep-blue precipitate (iodide of starch); with perchloride of iron, a faint bluish tint (gallate of iron); with subacetate of lead, or mercurous nitrate, a copious white precipitate; with nitrate of silver, a white precipitate, which soon becomes black; with tannin, a very slight, dirty-looking precipitate; and with a solution of gelatin, a slight haziness (P.). It was formerly supposed that the medicinal virtues of the seeds resided in the husk or cortical part, and it was advised not to bruise them in making the tincture, but experiments have proved that the bruised seeds yield the strongest tincture. Their properties are similar with those of the bulb, and, as they are considered more uniform in strength than the bulb, they are usually preferred.

Chemical Composition.—Of general plant constituents, colchicum bulbs contain gum, starch (more than one-fourth their weight), sugar, resin, tannin, and water (as high as 70 per cent). A volatile principle present in the fresh bulb, and to which its odor is due, is dissipated in drying. Fatty oil occurs in the seeds; Flückiger found 6.6 per cent, Rosenwasser 8.4 per cent. The peculiar constituent, common to all parts of the plant (bulbs, seeds, and flowers), is *colchicine*, concerning which there has been much discussion. Pelletier and Caventou (1820) thought it identical with veratrine, but Geiger and Hesse demonstrated it to be different. These and other investigators, however, describe it as a crystallizable body, but colchicine, as now established through the researches of Aschoff, Bley, Oberlin, Hubler, Maisch, Hertel, and Zeisel, can not be obtained in crystalline form. Oberlin, in 1856, made the discovery that, by evaporation of an acidulated solution of colchicine, a crystallizable body is formed, to which he affixed the name *colchiceine*. This is most probably the substance described by the earlier chemists. Hübler, in 1865, arrived at the conclusion that colchicine and colchiceine were isomeric bodies, which was proved erroneous by the more recent investigations of Zeisel

Hertel, in 1881, gave a process for the extraction of colchicine from the seeds, by which he obtained 0.4 per cent of pure colchicine. Aschoff had previously obtained about 0.2 per cent from seeds and 0.085 per cent from the bulb. Hertel also investigated the resinous coloring matter accompanying colchicine, to which he gave the name *colchico-resin*. He found it to be a decomposition product of colchicine due to exposure to the air, or to higher temperature, in a moist condition. He found it especially in the dead leaves surrounding the tubers, and in dried seeds and tubers. *Beta-colchico-resin* he observed in the process of making colchicëine from colchicine by means of diluted hydrochloric acid. Houdès, in 1885, concluded that he obtained crystallized colchicine, a point that S. Zeisel had, however, cleared, in 1883, by demonstrating that colchicine crystallizes from chloroformic solutions in the form of a chloroform compound. To Zeisel and Johanny (1888) is finally due the credit of having established the accurate formulæ for colchicine and colchicëine, and the chemical relationship the substances bear to each other.

Colchicine ($C_{22}H_{25}NO_6$, or $C_{15}H_9.[OCH_3]_3.NHCH_3CO.COOCH_3$) is the methyl-ester of *colchicëine* ($2C_{21}H_{23}NO_6+H_2O$, or $C_{15}H_9.[OCH_3]_3.NHCH_3CO.COOH$), the latter (crystallizable) body being formed by heating colchicine with dilute mineral acids, whereby methyl alcohol is split off. The question whether colchicine is an alkaloid, has been much debated. It is certain, however, that colchicine has weak basic properties, and yields precipitates with some alkaloidal reagents, yet, as a rule, it does not combine with acids to form a salt. Zeisel succeeded in establishing an exception by forming a double salt with gold chloride. Zeisel's colchicine melts at 143° C. (282.6° F.). Hertel describes *colchicine* as a sulphur-yellow body, impossible to crystallize, possessing a very slight alkaline reaction, but very indifferent body, the only noteworthy and insoluble compound being that with tannic acid. Colchicine is soluble in water, alcohol, and chloroform, hardly soluble in ether and benzol. Nitric acid has been recommended as the best reagent for the detection of colchicine, yielding a violet coloration. A mixture of nitric and sulphuric acids produces a series of colors changing from green to dark blue, violet and yellow (*Amer. Jour. Pharm.*, 1888, p. 569).

Colchicëine is described by Hertel as occurring in white and odorless crystals, readily soluble in alcohol, chloroform, and caustic potash, with yellow color; the fusing point is 150° C. (298° F.). With ferric chloride it yields a beautiful green coloration even in greatly diluted solution. The alcoholic solution feebly reddens litmus. Zeisel states that it has the double character of a weak base and an acid, which behavior its formula sufficiently explains. Like colchicine, it forms a double salt with gold chloride. Hübler, on the other hand, has prepared salts of colchicëine with bases. With the exception of the salts with alkalies, these compounds are insoluble in water, but soluble in alcohol and chloroform.

Apocolchicëine was obtained by Zeisel (1883) by heating colchicëine with diluted hydrochloric acid, methyl chloride being disengaged in the reaction. It has both basic and acid properties, and was first observed as a by-product, and obtained from colchicine in the preparation of colchicëine. H. Warnecke found in colchicum seeds 2.66 per cent of ash.

Action, Medical Uses, and Dosage.—Colchicum in small doses is stimulant, increasing the secretions of the skin, kidneys, liver, and bowels. Epigastric heat, eructations, and a sense of nausea accompany the administration of a large dose or several moderate doses. If the medicine be continued a coated tongue, anorexia, colicky pains, intestinal gurgling, and diarrhœa may result. Large doses occasion bilious vomiting, colic, tenesmus, and bloody mucoid evacuations, accompanied with anal heat. Toxic doses act as an acronarcotic poison, producing violent gastro-intestinal symptoms much like those of cholera—headache, vomiting, griping pain in the bowels, diarrhœa, painful cramps of the muscles and feet, collapse, decreased circulation, and death, probably from cardiac syncope Colchicine is a powerful poison, and should rarely be used. Medicinally, colchicum is sedative, cathartic, diuretic, and emetic. Used in *gout* and *gouty rheumatism*, *dropsy*, *palpitation of the heart*, *gonorrhœa*, *enlarged prostate*, etc. Care must be had in its employment. It sometimes increases the uric acid in the urine of arthritic patients; and has been beneficially employed in *febrile*, *inflammatory*, and *nervous affections*, and in *chronic bronchial complaints*. Equal parts of tincture of colchicum and laudanum have been found efficient in some cases of *gonorrhœa*. The reputation of colchicum rests most largely upon its value in *gout* and the conditions hinging upon a gouty diathesis. It is, perhaps, better adapted to acute than chronic gout. By its eliminative powers it removes from the system the morbid material upon which the gout depends. As a rule many of the failures to remedy this condition have been due to the fact that too large doses of colchicum have been employed. The dose will vary, however, some cases requiring larger doses than others, but in all cases the administration should be short of producing a free action from the bowels, the best effects being obtained from its slow and silent action. As a remedy for *rheumatism* it has been less employed. In *cardiac rheumatism* it may be alternated with the alkalies where the latter are indicated. The wine of colchicum may be given in 10-drop doses, or drop doses of specific colchicum may be given every 4 hours. As a rheumatism remedy it acts equally well in the acute and chronic conditions, provided the temperature and pulse be first brought almost to normal by means of other agents. Tearing muscular pain is the indication for it. It is efficient in *rheumatic iritis* and in *chronic rheumatism* when there is effusion into the joints and tearing pain aggravated by heat, and the joints present a swollen condition. *Dysmenorrhœa* and *hepatic enlargements* are also remedied by it when associated with a *gouty diathesis*. Large doses should never be used, and the action of the drug should always be carefully watched. Prof. Scudder employed small doses for *intestinal disturbances* with gaseous accumulation, as in *colic* from intestinal irritation. It has been used in *subacute* and *chronic sciatica* where the pain is "sharp-shooting, tearing, or dull-aching" from back to hip and down the leg, fever being absent. "It is not the kind of pain so much as its position" (Dr. L. A. Kelley).

A good acetic tincture may be made by macerating 1½ ounces of the dried bulb, or seeds, in 12 fluid ounces of the strongest vinegar for 14 days. Then filter and keep in well-stoppered bottles. The dose for an adult is from 10 to 60 drops as often as may be required. An acetic extract may be prepared, containing all the powers of the plant, by rubbing the fresh bulbs to a pulp to the quantity of a pound, and gradually adding acetic acid, 3 fluid ounces. Express the liquid, and evaporate it in an earthen vessel not glazed with lead, to the proper consistence; the dose is from 1 to 3 grains, 3 or 4 times a day. Dose of the dried bulb, from 1 to 10 grains, gradually increased every 4 or 6 hours, till the influence of the medicine is obtained. Wine of colchicum, 10 to 20 drops; English wine of colchicum, 5 to 10 drops; tincture of root, 10 to 60 drops; tincture of seed, 10 to 40 drops; specific colchicum 1 to 10 drops; colchicine, $\frac{1}{120}$ grain twice a day.

Specific Indications and Uses.—Gout; gouty diathesis; rheumatism, pain tearing and aggravated by heat, to be used after sedation has been accomplished; pain in course of the nerves; gouty headaches with swellings of joints, constipation, and nervousness; sudden tearing pain from back to hip, and down limbs, without fever.

COLLINSONIA.—STONE-ROOT.

The fresh root and plant *Collinsonia canadensis*, Linné

Nat. Ord.—Labiatæ.

Common Names: *Stone-root*, *Rich-weed*, *Rich-leaf*, *Knob-weed*, *Knob-root*, *Horse-balm*, *Horse-weed*, and improperly as *Hardhack* and *Heal-all*.

Illustrations: Meehan's *Native Flowers and Ferns*, II, 165; Millspaugh's *American Medicinal Plants*, Pl. 119.

Botanical Source.—Collinsonia is a perennial herb, having a square stem, smooth, or slightly pubescent, somewhat branching at the top, and growing from 2 to 4 feet high. The leaves are large, coarsely serrated, ovate, acuminate, lower ones petiolate, upper ones nearly sessile. The flowers, appearing in summer and early fall, are greenish-yellow, and are arranged in a terminal paniculate raceme. The corolla, funnel-shaped, is 2-lipped, with throat expanded, the lower lip being larger and fringed. The stamens, usually 2, are much exserted. The flowers exhale a balsamic odor, somewhat suggestive of the lemon, and the whole plant when bruised also gives this odor, which is rather disagreeable, especially in the root.

History.—Collinsonia is found in damp, shady situations, and in rich, moist woods, from Canada to Florida, and flowering from July to September. The whole plant has a peculiar, lemon-like, balsamic odor, rather disagreeable in the root, and a spicy, pungent taste. The fresh root, which is the part chiefly employed in Eclectic medicine, is exceedingly hard, requiring to be crushed in an iron mortar, in order to prepare it for pharmaceutical manipulation. It has a sharp, spicy taste. Water and alcohol extract its virtues, but boiling destroys its medicinal properties, as its active principle is evanescent. It is most familiar under the name *Stone-root*, because of the hardness of its root, and not, as stated by Johnson (*Med. Bot.*), on account of its having been formerly used in calculous affections. This plant was named in honor of Peter Collinson, an English merchant, botanist, and antiquarian, who introduced many American trees, shrubs, and plants into English gardens.

Chemical Composition.—Collinsonia has been analyzed by Mr. Lochman (*Amer. Jour. Pharm.*, 1885), and was found to contain resin, starch, tannin, wax in all parts of the plant, mucilage in the root, and volatile oil in the leaves. The therapeutic constituent or constituents of collinsonia have never been recorded if determined. The old Eclectic concentration (or resinoid), has long since become obsolete in the practice of modern Eclectics. It is a mixture of uncertain composition.

Action, Medical Uses, and Dosage.—Collinsonia is said to be alterative, tonic, stimulant, and diuretic. It acts principally on the venous system and mucous tissues, and undoubtedly has a marked action on the vagus, relieving irritation in parts to which that nerve is distributed. Minute doses of the green plant will promptly provoke emesis. The warm infusion will induce perspiration. It has long been a popular domestic remedy for various disorders. The bruised leaves were applied as a poultice in *burns*, *bruises*, *wounds*, *ulcers*, *sores*, *sprains*, *contusions*, and for internal abdominal ailments. The root was used in *female complaints*, *piles*, *urinary diseases*, and *gastro-intestinal affections*.

The remedy has been used with varying degrees of success by the profession in female disorders, as *amenorrhœa*, *dysmenorrhœa*, *menorrhagia*, *vicarious menstruation*, *prolapsus uteri*, *leucorrhœa*, *threatened abortion*, and *pruritis vulvæ*, dependent on varicosis.

Stone-root, being diuretic and tonic, was formerly much used in genito-urinary troubles. It was highly thought of in *calculous diathesis*. While very much overrated, it is probable that it was not without beneficial results in toning the renal organs and allaying irritation consequent upon the presence of *gravel*. It is certainly a good remedy in *vesical catarrh*. Good results have come from its employment in *spermatorrhœa* and *varicocele*, when accompanied by *piles*. *Catarrhal conditions*, whether of renal, vesical, or genito-urinary organs, or of the respiratory mucous surfaces, are speedily benefited by it. Even the *cough of phthisis* is rendered much less harassing by its administration.

One of the first uses of collinsonia by Eclectics was in the treatment of that form of *laryngitis* known as "*minister's sore throat*." For this condition it is the best agent we possess. It is equally valuable in other forms of *chronic laryngitis*, *pharyngitis*, and in some cases of *chronic bronchitis*, and *tracheitis*. It is an excellent remedy for *aphonia*, resulting from vascular hyperemia, or from congestion. In *throat troubles:* ℞ Specific collinsonia, flʒii to fl℥j; simple syrup, q. s., fl℥iv. Mix. Sig. Teaspoonful every 3 or 4 hours.

In *diseases of the gastro-intestinal tract*, it is beneficial in relieving irritation, improving the appetite, promoting the flow of gastric juice, and in exerting a decided tonic effect upon the organs involved. It is more clearly indicated when *piles* are present as a complication. It is a good remedy in *indigestion*, *irritative dyspepsia*, *chronic gastritis*, *chronic gastric catarrh*, *diarrhœa*, *dysentery*, *colic*, and *spasmodic conditions of the stomach* and *intestines*. By its tonic action upon the bowels, it is a valuable remedy for *constipation*. Perhaps one of the most direct indications for collinsonia, is a hemorrhoidal and constipated state due to vascular engorgement of the pelvic viscera. The most marked symptoms calling for it will be a sense of constriction, heat, and weight in the rectum, with dry, scybalous feces. Under these conditions the remedy gives marked relief, especially in pregnant women. In rectal ailments give the small dose: ℞ Specific collinsonia, gtt. x to xv; aqua, fl℥iv. Mix. Sig. Teaspoonful every 3 or 4 hours. It is useful also in *hemorrhoids* where there is rectal irritation, with the feces partly scybalous and partly semi-fluid, no constipation being present. Prof. Scudder has found it to effect cures in doses of 1 or 2 drops of specific collinsonia in water, repeated 3 or 4 times a day. *Subacute proctitis*, the tenesmus accompanying *dysentery*, and *dysenteric cholera infantum*, *rectal pain* and *inflammation* following surgical operations in that region, irritation attending *anal fistulæ*, *rectal ulcers* and *pockets* are all relieved by collinsonia, the latter conditions, however, being only palliated by it. It relieves *neurotic pains* in the rectal region, though no appreciable lesion be observed, and certain forms of *hypogastric pain* are relieved by it when not due to bladder trouble. All of these pains are more amenable to it when associated with *rectal capillary congestion*. Prof. J. M. Scudder valued this agent very highly as a stimulant and tonic in cases of *atonic dyspepsia*, and in chronic disease with feeble digestion, increasing secretion from the kidneys and skin, and in a marked manner relieving irritation of the nervous system and increasing innervation. In chronic diseases of the respiratory apparatus it relieves *pulmonary irritation* and acts as a stimulating expectorant. In *irritation of the pneumogastric nerve*, *heart disease*, and that peculiarly distressing *asthma* simulating. and sometimes attending *phthisis*, he has observed more particularly its superior influence in quieting irritation, giving increased strength and regularity to the heart's action, and increasing the strength of the patient. Collinsonia acts upon the tissues and valves of the heart, relieving irritation, increasing its power to act, and regulating its contractions. It is a serviceable drug in *hydropericardium*, *rheumatic heart troubles*, and functional disturbances due to irritation of the stomach. *Mitral regurgitation* and the distressing *cough of heart disease*, are greatly benefited by its administration. ℞ Specific collinsonia, gtt. iij every hour. Lack of tonicity of the blood vessels is overcome by collinsonia. In short, passive vascular engorgement with dilated capillaries, torpid portal circulation, and lack of muscular tonicity, call for stoneroot. The keynote is a *sense of weight and constriction* in the part affected.

Foltz uses collinsonia in *ear diseases* with increased secretions non-purulent in character, failing to get good results after suppuration ensues; he also employs it in the early stage of middle ear disorders when *follicular pharyngitis* and *hypertrophied Luschka's glands* are complications.

Other species of Collinsonia probably possess similar virtues. Dose of the infusion, from ½ to 2 fluid ounces. Webster prefers a strong tincture of the green plant to that of the root, in doses of a fraction of a drop to 5 drops in acute cases, 4 or 5 times a day in chronic troubles; specific collinsonia (root), $\frac{1}{10}$ to 15 drops, the smaller dose being preferable in hemorrhoids; tincture, 10 to 30 drops 4 times a day.

Collinsonin.—This concentration is a light-brown powder resembling snuff in appearance, and has a slightly bitter, sharp taste. It is but little used.

Specific Indications and Uses.—Prof. Scudder points out as indications for this drug, "a sense of constriction, with irritation in throat, larynx, or anus; a sense of constriction with tickling in throat, with cough arising from use of the voice; a sensation as if a foreign body were lodged in the rectum, with contraction of sphincter, and contracted and painful perineum." Sticking pain in the larynx, heart, or bladder; contracted abdomen; vesical tenesmus; minister's sore throat.

COLLODIUM (U. S. P.)—COLLODION.

Preparation.—"Pyroxylin, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; ether, seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏.]; alcohol, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏.]. To the pyroxylin, contained in a suitable bottle, add the ether, and let it stand for 15 minutes; then add the alcohol, and shake the bottle until the pyroxylin is dissolved. Cork the bottle well, and set it aside until the liquid has become clear.

Then decant the clear portion from any sediment which may have formed, and transfer it to bottles, which should be well corked. Keep the collodion in cork-stoppered bottles, in a cool place, remote from lights or fire"—(*U. S. P.*). The *U. S. P.* process of earlier years prepared both the pyroxylin and the collodion at one operation. The present official process wisely directs the use of ready-prepared pyroxylin (see *Pyroxylinum*).

Description.—Collodion is a colorless, thickish liquid, having a neutral reaction, an ether-like odor and taste, and unless it be kept in well-secured vessels, it thickens and becomes unfit for surgical use, frequently depositing acicular crystals of gun-cotton. When prepared from gun-cotton slightly decomposed, it has an acid reaction, and yields an opaque residue, which is not adhesive, and consequently useless (see *Pyroxylinum*).

Action and Medical Uses.—When placed upon the surface of the body, the part being dry, by evaporation of the ether, a transparent, extremely electric and adhesive film is left, forming an artificial epidermis; in drying, the collodion contracts very strongly, producing local pressure. By thus limiting in a measure the supply of blood, it aids in allaying congestion and inflammation, and materially reduces pain. It has been successfully used in *sore nipples*, *erysipelatous diseases*, *leech-bites*, *bee-stings*, *ulcers*, *burns*, *wounds*, *abrasions*, and several *cutaneous diseases*, over which, when applied, it forms a coating impervious to air, and not affected by water. It forms a good compressor in *orchitis*, *felons*, and *sprains*, and acts well as a splint in *fractures of small bones*, like those of the nose. It is largely used to protect *wounds* and *abrasions* upon the hands of those engaged in dissecting dead bodies, or in performing surgical and gynaecological operations. It may be placed upon the part by means of a camel's hair brush, or by layers of thin muslin. In *ulcerations* around the neck of the uterus, collodion has been found beneficial, forming, after the evaporation of the ether, a thin film or coating over the ulcers, thus protecting them from atmospheric influence, and from the vaginal secretions, and facilitating their healing. Collodion is said to have given instant relief in *chilblains*. In many instances, collodion is not commendable, on account of its powerful contraction, which, however, may be obviated by adding to a solution of 1 drachm of gun-cotton in $2\frac{1}{2}$ ounces of ether, 1 drachm of Venice turpentine. M. Sourisseau renders collodion more pliable by adding $\frac{1}{12}$ part of elemi to it. This same property is imparted to it, as stated by M. Startin, by adding $\frac{1}{8}$ or $\frac{1}{16}$ of an ethereal solution of animal fat. Collodion may likewise be prepared pliable and without any tendency to crack or break, by the following formula: Take of collodion, 30 grammes; castor-oil and soft turpentine, of each 50 centigrammes. This is similar in composition to the official *Collodium Flexile*, which was designed for use where great compression is not desirable.

Related Bodies.—PHOTOXYLON. A nitro-cellulose, prepared from wood pulp by process of nitration, similar to that for preparing collodion. It is completely dissolved by a mixture of equal amounts of strong ether and alcohol. Upon evaporation a 3 per cent solution leaves a tough collodion-like film (Beringer, *Amer. Jour. Pharm.*, 1888, p. 225). This agent is preferred by some to collodium, as being more impermeable to fluids, adheres better, and exerts a more equal compression of the parts to which it is applied. It is applicable to small *genital* and *facial wounds*, etc.

KAURI GUM.—An exudation from the *Dammara australis*, of New Zealand. When freshly exuded it has little value, but after lying in the soil for a time it is dug and then becomes useful. It is an amber-like body, varying in color from cream to amber. When distilled it yields an oil which is chiefly terpene. A solution of this gum in an equal quantity of alcohol (90 per cent) forms *Baume Calédonien*, a substitute for collodion and for soluble glass. This solution has been lauded in the treatment of *wounds*, *ulcers*, and in *eczematous* and similar *skin diseases*. It leaves an insoluble varnish upon the parts to which it is applied, the film not being easily removed even by friction.

COLLODIUM CANTHARIDATUM (U. S. P.)—CANTHARIDAL COLLODION.

SYNONYMS: *Blistering collodion*, *Collodium vesicans*, *Collodium cantharidale.*

Preparation.—"Cantharides, in No. 60 powder, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; flexible collodion, eighty-five grammes (85 Gm.) [2 ozs. av., 437 grs.]; chloroform, a sufficient quantity; to make one hundred grammes (100

Gm.) [3 ozs. av., 231 grs.]. Pack the cantharides firmly in a cylindrical percolator, and gradually pour chloroform upon it, until the powder is exhausted. Recover the chloroform by distillation from a water-bath, and evaporate the residue, in a capsule, on a water-bath, until it weighs fifteen grammes (15 Gm.) [231 grs.]. Dissolve this in the flexible collodion, and set it aside to become clear by settling. Finally pour off the clear portion from any sediment which may have formed, and transfer it to bottles, which should be securely corked. Keep the cantharidal collodion in cork-stoppered bottles, in a cool place, remote from lights or fire"—(*U. S. P.*).

Action and Medical Uses.—Cantharidal collodion is used as a vesicant. As an epispastic it is preferred to cantharidal cerate, which it equals in power, being better adapted to uneven parts, and retaining itself better in position. The parts having been well cleansed and dried the blistering agent may be applied by means of a brush, and if, after evaporation of the ether, the parts are not thoroughly covered, it may be reapplied. If covered with oiled silk quicker results may be obtained.

COLLODIUM FLEXILE (U. S. P.)—FLEXIBLE COLLODION.

Preparation.—Collodion, nine hundred and twenty grammes (920 Gm.) [2 lbs. av., 198 grs.]; Canada turpentine, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; castor oil, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Weigh the ingredients, successively, into a tared bottle, and mix them thoroughly. Keep the product in cork-stoppered bottles, in a cool place, remote from lights or fire.

Description.—Flexible collodion closely resembles collodion in appearance. When evaporated it forms a film which is barely contractile and is elastic.

Action and Medical Uses.—Flexible collodion is intended for use chiefly as a protective, where the strongly contractile properties of collodion are not desirable. Like the other collodions it may be applied with a camel's hair brush. Croton oil, cantharides, iodine, salicylic acid, chromic acid, corrosive sublimate, zinc, iron, and copper salts, tannin, etc., are sometimes incorporated with flexible collodion. On account of the intimate contact produced in this way, great care should be exercised in the use of these agents.

Medicated Flexible Collodions.—COLLODIUM IODATUM. (N.F.) *Iodized collodion. Formulary number*, 24: "Iodine, reduced to powder, 5 grammes (5 Gm.) [77 grs.]; flexible collodion (*U. S. P.*), ninety-five grammes (95 Gm.) [3 ozs. av., 154 grs.]. Introduce the iodine into a bottle, add the flexible collodion and agitate until the iodine is dissolved" (*Nat. Form*).

COLLODIUM IODOFORMATUM. (N.F.) *Iodoform collodion. Formulary number*, 25: "Iodoform, five grammes (5 Gm.) [77 grs.]; flexible collodion (*U. S. P.*), ninety-five grammes (95 Gm.) [3 ozs. av., 154 grs.]. Dissolve the iodoform in the flexible collodion by agitation" (*Nat. Form.*).

COLLODIUM TIGLII. (N. F.) *Croton oil collodion. Formulary number*, 26: "Croton oil, ten grammes (10 Gm.) [154 grs.]; flexible collodion (*U. S. P.*), ninety grammes (90 Gm.) [3 ozs. av., 76 grs.]. Mix them" (*Nat. Form.*).

COLLODIUM SALICYLATUM COMPOSITUM. (N. F.) *Compound salicylated collodion. Corn collodion. Formulary number*, 27: "Salicylic acid, eleven grammes (11 Gm.) [170 grs.]; extract of Indian hemp, two grammes (2 Gm.) [31 grs.]; alcohol, ten grammes (10 Gm.) [154 grs.]; flexible collodion (*U. S. P.*), a sufficient quantity; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Dissolve the extract of Indian hemp in the alcohol, and the salicylic acid in about fifty grammes (50 Gm.) [1 oz. av., 334 grs.] of flexible collodion contained in a tared bottle. Then add the former solution to the latter, and finally add enough flexible collodion to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]" (*Nat. Form.*). This preparation is largely used as an application to *corns*.

COLLODIUM STYPTICUM (U. S. P.)—STYPTIC COLLODION.

SYNONYMS: *Styptic colloid, Xylostyptic ether, Collodium hæmostaticum.*

Preparation.—"Tannic acid, twenty grammes (20 Gm.) [309 grs.]; alcohol, five cubic centimeters (5 Cc.) [81 ♏]; ether, twenty-five cubic centimeters (25 Cc.) [406 ♏]; collodion, a sufficient quantity, to make one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Introduce the tannic acid, alcohol, and ether into a graduated bottle, agitate until the tannic acid is thoroughly incorporated and partially dissolved, then add enough collodion to make up the volume to one hundred cubic centimeters (100 Cc.) [3 fl℥. 183 ♏], and shake occasionally until the acid is completely dissolved. Keep the product in cork-stoppered bottles, in a cool place, remote from lights or fire"—(*U. S. P.*).

The hemostatic effect of collodion is increased by the following *Collodium tannatum* (*Pavesi's styptic collodion*): Take of collodion 100 parts, carbolic acid 10 parts, tannin 5 parts, benzoic acid 3 parts; mix.

Action and Medical Uses.—This agent, as its name implies, is intended as a styptic to small *bleeding surfaces*. It may be applied simple or combined with medicinal agents, such as morphine, carbolic acid, etc., to *abrasions*, *ulcerations*, and *wounds*, especially of the scalp. The parts must be thoroughly cleansed, and the collodion applied by means of a small brush, or with cotton wool.

COLOCYNTHIS (U. S. P.)—COLOCYNTH.

"The fruit of *Citrullus Colocynthis*, Schrader, deprived of its rind"—(*U. S. P.*). (*Cucumis Colocynthis*, Linné; *Colocynthis officinarum*, Schrader).

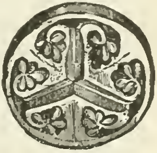
Nat. Ord.—Cucurbitaceæ.

COMMON NAMES: *Bitter apple*, *Bitter cucumber*, *Colocynth pulp*.

ILLUSTRATIONS: Köhler's *Medizinal-Pflanzen*, Vol. 1, Plate 118; Bentley and Trimen, *Med. Plants*, 114.

Botanical Source.—Colocynth is an annual plant, with a whitish root, and prostrate, angular, hispid stems. The leaves are alternate, cordate, ovate, many-lobed, and white, with hairs beneath; the lobes obtuse; the petioles as long as the lamina. The tendrils are short. The flowers axillary, yellow, solitary, and stalked; the females, with tube of the calyx globose, somewhat hispid, and the limb campanulate, with narrow segments. The petals are small. The fruit is globose, smooth, the size of an orange, and yellow when ripe, with a thin, solid rind, and very bitter flesh.

Fig. 81.



Fruit of Citrullus Colocynthis.

History.—The bitter apple, or cucumber, is a native of Northern Africa (overrunning the sandy spots of Nubia and Upper Egypt after the rainy period), the Cape of Good Hope, Western Asia, Japan, etc., and is cultivated in Italy and Spain. The fruit assumes a yellow or orange color externally during the autumn, at which time it is collected, and dried quickly, either in a stove or in the sun, after which it is peeled. The colocynth with which the United States is supplied, is chiefly derived from the Mediterranean ports. That which is deprived of its rind, and is very white, light, and spongy, is considered the best article; and the grayish or brownish drug, owing to careless curing, is of the poorest quality. The fruit, as usually met in commerce, is about the size of a small orange, or more generally in broken apples or fragments of the drug devoid of seeds. Occasionally the drug is found with the brown, dried rind intact. A Persian colocynth occurs in the London markets, having a shrivelled appearance, with the seeds tightly imbedded in the pulp, owing to the fact that it has been peeled while still fresh, but the drug of commerce is usually divested of its rind after having been dried. The yellowish-brown seeds ($\frac{3}{10}$ inch long by $\frac{1}{5}$ inch broad) are ovate, flat, and composed of a thick, hard testa, enclosing 2 oily cotyledous, and arranged on the 3 placentæ so as to give the 1-celled fruit a 6-celled appearance. They have been used for food by the poorest Saharan tribes, after being deprived of all the pulp and heated by boiling, roasting, or baking (Flückiger). A paste of the root and fruit is used locally on pimples and boils, and the root (paste), is spread upon enlarged bellies in children, and for rheumatic complaints the root, combined with an equal quantity of long pepper, is administered in pill form in (the Concan) India (Dymock).

Description.—"From 5 to 10 Cm. (2 to 4 inches) in diameter; globular; white or yellowish-white; light, spongy; readily breaking into 3 wedge-shaped pieces, each containing, near the rounded surface, many flat, ovate, brown seeds; inodorous; taste intensely bitter. The pulp only should be used, the seeds being separated and rejected"—(*U. S. P.*).

Chemical Composition.—Meissner, in 1818, made a chemical analysis of colocynth. He obtained the bitter principle in an impure form, and called it *colocynthin*. The fruit was further investigated, and various modes of isolating colocynthin were proposed by Vauquelin (1818), Braconnot (1819), Herberger (1830), Labourdais (1848), Bastick (1850), Hübschmann (1858), and Walz (1858), and again, more recently by G. Henke (*Archiv. der Pharm.*, 1883, p. 200). According to Walz, *colocynthin* is a glucosid, the action of diluted acids resolving it into *colocynthein*, a resinous body, and sugar. Walz also describes a crystalline substance, *colocynthitin*, insoluble in water and cold absolute alcohol, but soluble in ether and boiling alcohol. Henke could not obtain colocynthin in crystals, which was the form claimed for it by Walz; contrary to Walz, he also found it insoluble in benzene. Henke's *colocynthin* is insoluble in chloroform, ether, carbon disulphide, and petroleum ether, but is soluble in water (rendering the solution very bitter), alcohol, ammonia water, and an aqueous solution of chromic acid. Tannic acid precipitates it completely from aqueous solution. From 5 kilograms of colocynth deprived of seeds, Henke obtained only 30 grams of colocynthin, and recommends the use of the drug in fresh condition. E. Johannson, in 1885, found *colocynthein* to be less soluble than colocynthin in water, and in acid solution soluble in benzene, which affords a means of separating it from colocynthin. Colocynthin he also found soluble in acetic ether.

Colocynth contains about 4 per cent of fatty oil which is used in India as a remedy (*Jahresbericht der Pharm.*, 1892, p. 28). In addition to the foregoing, Mr. George Wagner (*Proc. A. P. A.*, p. 179), examined colocynth in 1893, and (*Amer. Jour. Pharm.*, p. 272), Prof. L. E. Sayre investigated American colocynth in 1894.

Action, Medical Uses, and Dosage.—Colocynth is irritant and cathartic. It acts very powerfully, producing copious watery evacuations. Even in moderate doses, it has excited inflammation of the mucous membrane of the intestines, vomiting, severe tormina, and bloody stools. Except in minute doses, it is never used alone, because its violence is greatly mitigated, while its efficacy and certainty are not impaired, by uniting it with other cathartics, as aloes, scammony, etc. The addition of extract of hyoscyamus will likewise deprive it of its harsh and griping effects. Its principal employment in material doses is in *passive dropsy*, in *cerebral derangements*, and in pills with other cathartics for the purpose of overcoming torpid conditions of the biliary and digestive systems. However, it is scarcely ever used for these purposes in our school to-day. Its irritant effect upon the rectum may influence the uterus by sympathy of contiguity, and thus provoke menstruation, and on the same principle, dissolved in whiskey, it has cured *gonorrhœa*. It has been used in moderate doses, in all diseases where catharsis is indicated. The powder applied to an ulcer, or raw surface, affects the lower bowels in the same manner as when taken internally, and the tincture applied to the abdomen has purged, and more actively when the surface has been denuded of its epidermis. It is said that Hippocrates used the colocynth apple as a pessary for the purpose of exciting menstruation. Debility and even slight gastro-intestinal inflammation contraindicate the use of colocynth. Later years have developed the true sphere of colocynth as a remedy, and that use is not as a cathartic. It is essentially a remedy for *visceral pain*, and the dose should be very small. Not more than 5 or 10 drops of the specific colocynth should be added to 4 ounces of water, of which the dose is a teaspoonful. Even better are the same number of drops of the 1 x dilution of the specific medicine. The pain calling for colocynth is cutting, darting, cramping, or tearing. It is of great value in *stomach and intestinal disorders* with sharp "belly-ache," and meets these disorders even when rheumatoid, and is particularly valuable in *neuralgic pains of the viscera*. The patient is cold, weak, and feels faint; the pain of a sharp character causing him to flex his body upon his thighs. The back, joints, and bones feel stiff and sore, as if bruised, and the abdominal pain is made worse by motion. It is an important remedy in *dyspepsia*, with bitter taste, bilious yellow and bitter eructations, and bloating after eating, accompanied with sharp griping or cutting, colic-like pain in the umbilical region. The minute dose here acts best: ℞ Specific colocynth, 1 x dil., gtt. j to x; aqua, fl℥iv. Mix. Teaspoonful every 3 or 4 hours. The same characteristics indicate it in *flatulent*, *worm* and *bilious colics*. The accumulation of gases may be large, producing by distension disturbances of the breathing organs and heart, with much anxiety, and belching, or expulsions of flatus may be symptoms, and nausea and vomiting are not uncommon. *Cholera infantum* sometimes presents many of these symptoms, and colocynth will give prompt relief. *Chronic diarrhœa*, with slimy stools and distended abdomen and the characteristic pain, or *diarrhœa* due to overeating or improper food are relieved by it. In *dysentery*, with cutting tormina and tenesmus and ineffectual efforts at stool, it is an admirable remedy. It should not be overlooked in *liver disorders* with tympanites, constipated bowels, and sharp, darting pains in the liver region; and in the *chronic constipation* of women and children with the symptoms above mentioned, and, in addition, dry, hard scybalous feces, its tonic action is marked and gastric and intestinal digestion improved, with a consequent improvement of the constipated state. In fact, in chronic disorders of any kind in which colocynth aids, there is an evident intestinal and hepatic inactivity. Certain forms of *headache*, with the colocynth pain, whether neuralgic or reflex from stomach troubles, are remedied with colocynth. It exerts a direct influence upon the nervous system, relieving *neuralgia* of the parts supplied by the solar plexus, *neuralgic colic*, *ovarian neuralgia*, *orchialgia*, *neuralgia of the fifth nerve*, and *sciatica*, all presenting the characteristic sharp, cutting pain. The same is true in *rheumatic complaints* and *lumbago*. Colocynth is decided in its action upon the female organs of reproduction. When colicky pains precede or accompany *amenorrhœa*, and pressure gives relief, colocynth is the remedy; other painful states of these organs are relieved when the cases are properly selected. A characteristic of colocynth is that, if it is to help at all, it helps quickly, but the smaller doses should be tried before a failure is declared. The oil of colocynth has been recommended as an external remedy for *neuralgia*. The dose for the old cathartic use of colocynth is from 4 to 10 grains, either in powder or aqueous extract; of the alcoholic extract, from 1 to 4 grains. When to be given alone, it should be triturated with some inert or insoluble powders, as gum or farinaceous matter, in order to diminish its severity of action. For the newer and specific uses of colocynth: ℞ Specific colocynth (or 1 x dil.), gtt. j to x, aqua, fl℥iv. Mix. Dose, a teaspoonful every 1 to 4 hours.

Specific Indications and Uses.—Pain of a cutting, twisting, boring, griping, contractive character, and if of the gastro-intestinal tract, accompanied with a desire to go to stool; colicky pains in the umbilical, iliac, and hypogastric regions; dysentery, with tormina in right iliac region or diffused over the abdomen; diarrhœa, with shining, mucoid passages, and tenesmic, colicky pain; constipation, with dry scybalæ and sharp, griping pain in the lower bowel; flatulent eructations and discharges; tensive rheumatic pain, with contractions; visceral neuralgia of cutting character.

Related Species.—*Cucumis trigonus*, Roxburgh (*Cucumis Pseudo-colocynthis*, Royle); *Karit*.—North India, especially the presidency of Bombay. The fruit is exceedingly bitter, and resembles a small egg streaked with yellow and green. It is carried into market during the Hindu New Year feast. At this time the Bombay Hindus are accustomed to crush a gourd with the foot, touch the forehead and tongue with it, thus, of their own accord, *tasting bitter*, hoping thereby to be protected and preserved from calamities throughout that year. It is employed medicinally, but not for food. A variety (var. *pubescens*), not so bitter, after soaking in salt water, is eaten like the cucumber, and the seeds are employed in *herpes* (see Dymock, *Mat. Medica Western India*).

Cucumis Hardwickii, Royle; *Hill colocynth of India*.—Purgative

Cucumis prophetarum, Linnæus.—Arabia. Purgative.

Luffa operculata, Cogn.—Brazil. The drastic fruit of this plant has been employed in affections for which colocynth is used. The boiled fruit pulp is strained, beaten into froth, and, when cold, given in tablespoonful doses for *dropsical complaints* until either purging or vomiting is induced. It is quite a popular domestic remedy in its native habitat (*Amer. Jour. Pharm.*, Vol. 56). For *Luffa echinata*, Roxburgh and its constituents, see *Amer. Jour. Pharm.*, 1888, p. 486.

Luffa acutangula var. *amara*, Roxburgh.—The *Karvi-turai* of the Hindus who employ the fruit and vine medicinally. It possesses cathartic and emetic properties for which purposes the infusion of the ripe seeds is generally preferred. The juice of the fruit is employed locally for *headache* and *bites*. The bitter leaves are employed in Bombay for *sores* upon cattle (Dymock, *Mat. Med. Western India*).

Cucumis myriocarpus.—The *Cacur* of southern Africa. Has active emeto-cathartic properties, similar to those of colocynth, and, after heating, is used by the natives for its emetic action. It contains a neutral, resinous substance (*myriocarpin*) which is also emeto-cathartic.

CAYAPONINE.—The alkaloid extracted by Gubler from *Cayaponia globulosa* (*Nat. Ord.*—Cucurbitaceæ), of Brazil. In doses of $\frac{1}{10}$ grain it is said to purge without pain.

COMPTONIA.—SWEET FERN.

The plant and especially the leaves and tops of *Comptonia asplenifolia*, Aiton (*Myrica asplenifolia*, Linné; *Myrica Comptonia*, De Candolle).

Nat. Ord.—Myricaceæ.

Common Names: *Sweet fern, Meadow fern, Ferngale.*

Botanical Source.—Sweet fern is a low, indigenous shrub, with a long, horizontal root, and growing from 2 to 4 feet high, the main stem being covered with a rusty, brown bark, which becomes reddish in the branches, and white-downy in the young shoots. The leaves are numerous, on short peduncles, from 3 to 4 inches in length, ½ inch broad, alternate, linear-lanceolate, sinuate-pinnatifid, resembling the leaves of the spleenwort fern, brown, rather downy on the under side, shining on the upper. The stipules in pairs and acuminate. The flowers are green, monœcious, amentaceous, appearing before the leaves; barren ones in long, erect, cylindrical, loosely imbricated catkins, terminal and lateral, with deciduous, 1-flowered bracts; the fertile ones in ovate, densely imbricated catkins, situated below the barren ones, with 1-flowered bracts. Stamens 6, adhering in pairs. Sepals 6, larger than the bracts; styles 2, capillary. The fruit is a small, ovate, brown, 1-celled nut (L.—W.).

History.—This plant is found growing in thin, sandy soils, or dry, rocky woods, from Maine to Kentucky, flowering in May. The whole plant possesses a spicy, aromatic odor, especially when bruised, and an aromatic, astringent, faintly bitterish taste. The whole herb is used, and imparts its virtues to water or alcohol. The leaves have been used in the rural districts of New York state as a substitute for tea.

Chemical Composition.— H. K. Bowman (*Amer. Jour. Pharm.*, 1869, p. 194), found the leaves to contain 8.2 per cent of tannin, corroborated by Charles G. Manger, who, in 1894, made a complete analysis of both the rhizome and the leaves of Myrica asplenifolia. He found the amount of tannin to vary with the season; dried January leaves containing 7.06 per cent, July leaves 10.28 per cent. Tannin in the dried rhizome reached a maximum of 6 per cent in a sample collected in August. Starch was not found in the leaves, but the rhizome contained 8.24 per cent. By distilling the leaves with water, Mr. Manger isolated a small amount of an aromatic volatile oil, which was liable to resinify upon exposure to the air. R. T. Chiles, in 1873, found gallic acid in the leaves, the usual plant constituents, and a body resembling saponin. Peacock subsequently could detect traces only of gallic acid in a January specimen of the rhizome, and none at all in a specimen collected in June (*Amer. Jour. Pharm.*, 1892).

Action, Medical Uses, and Dosage.—Tonic, astringent, and alterative. Used in *diarrhœa, dysentery, hemoptysis, leucorrhœa, rheumatism, debility* succeeding *fevers*, and in *rachitis*. A decoction of it is very useful in the *summer complaints of children*, when given as an auxiliary. A pillow of the leaves is beneficial to rachitic children, and they may be used as a fomentation *in contusions* and *rheumatism*. Dose of the decoction, from 1 to 4 fluid ounces, 3 or 4 times a day.

CONDURANGO.—CUNDURANGO.

The bark of *Gonolobus Cundurango*, Triana (*Marsdenia Condurango*, Reichenbach).

Nat. Ord.—Asclepiadaceæ.

Common Names: *Eagle vine, Mata-peroo.*

Botanical Source.—This plant is a twining vine, having opposite cordate leaves, which are cuspidate and sinuately narrowing on the margins, hairy above and silky and tomentose underneath. The flowers are borne in loose cymes. The peduncles and petioles are covered with a pale, grayish pubescence, and the stem, which reaches a thickness of from 1 to 5 inches and a great height, has a greenish-gray bark, which, when cut or bruised, exudes a viscid, milky juice.

History.—Cundurango was introduced, in 1871, in rather an official manner, having been received by the State Department at Washington, from the Minister of Ecuador. The drug was accompanied by certificates from two physicians of the province of Loja, attributing to the bark great power to cure cancer, syphilis, etc. The statements were supported by a letter from our Minister at Ecuador. An analysis of the plant (see below) threw but little light upon the subject, as substances common to most plants only were found. Shortly after it came into notice, a note from Mr. Dan. C. Robbins, of New York, to the editor of the *Amer. Jour. Pharm.*, stated that Mr. Wiehl, United States Consul at Guayaquil, had favored him with specimens of the flowers, leaves, and fruit of the true condurango vine. It was stated that the name condurango meant "Eagle vine," or "Condor-vine," and that there were some 6 varieties, 3 of which were used in medicine, and were known in Spanish by names signifying dog-killer, big fruit, and little fruit. The "dog-killer," which is true condurango, is a tropical climbing vine, seeking the highest trees of the cinchona region of South America. Doubtless, the market is supplied with barks of several species of climbing plants.

Description and Chemical Composition.—The bark only is recommended for use. It is in thin pieces, of a whitish or yellowish color, in appearance reminding one of the bark of ptelea root. The taste is slightly bitter and aromatic. Thomas Antisell (*Amer. Jour. Pharm.*, 1871) found in 100 parts of condurango bark: Moisture (8 per cent), ash (12 per cent), fatty matter (7 per cent), yellow resin, soluble in alcohol (2.7 per cent), gum and glucose from starch (0.5 per cent), tannin and coloring matters (12.6 per cent), cellulose, lignin, etc. (63.5 per cent). In 1872, Vulpius observed a precipitate that formed upon warming of a clear, aqueous infusion of the bark, and which suggested the presence of a substance related to Tanret's *vincetoxin*, from the root of Asclepias vincetoxicum. In 1885, Vulpius pronounced the glucosidal nature of this substance, which he named *condurangin*, admitting, however, that it might not be a simple body. A 2 per cent solution in water has the property of gelatinizing upon warming, and becoming clear again when cold. Condurangin, while a glucosid, also reacts with alkaloidal reagents. Vulpius resolved it into two substances, one soluble in water, and insoluble in ether, and another with these solubilities reversed (*Archiv. der Pharm.*, 1885, p. 299).

Kobert and Jukna (1888) investigated condurangin both chemically and physiologically, and Carrara (1892) examined Vulpius' decomposition products, establishing formulæ and melting points for both. He also announced the presence of a new glucosid of the formula $C_{40}H_{74}O_6$, having a melting point of 112° C. (233.6° F.), insoluble in ether, sparingly soluble in cold alcohol, and very slightly soluble in water. It is not precipitated by Mayer's reagent, nor with iodine in solution of iodide of potassium. The same observer found *conduransterin* ($C_{30}H_{50}O_2$), melting point 52° C. (125.6° F.), a body related to cholesterin. It is contained in the ether solution of the precipitate formed in the cooled alcoholic extract. *Cinnamic acid* was also isolated from the mother-liquors. Schroff and Schmiedeberg, (*Med. Chir. Rundschau*, 1871–2) believed that an alkaloid, resembling strychnine in its action, must be present in the bark, and Flückiger, in 1882, obtained minute quantities of an alkaloid.

Action, Medical Uses, and Dosage.—This agent, at one time so highly lauded as a positive remedy for *cancer* and *syphilis*, is rarely employed at the present time, and should it possess any valuable therapeutic virtues, they are not likely to be ascertained for some time to come, as the exaggerated statements and misrepresentations attending its introduction have led the profession to regard it with suspicion and incredulity. It is probable, however, that it has a tonic effect in *gastric debility*, and especially relieves pain in the stomach. Condurangin, according to Kobert, acts upon the central nervous apparatus, producing in animals impairment of appetite, vomiting, ptyalism, muscular weakness, convulsions and paralysis. Of condurango a decoction (bark ℥ss to aqua Oj boiled down to Oss.) may be given in tablespoonful doses 3 times a day; fluid extract, 5 to 30 drops.

CONFECTIONES.—CONFECTIONS.

The Pharmacopœias still recognize two members of a class of preparations, but little used at the present, and yet modifications of them were very important medicines in former times under the terms *conserves* and *electuaries*. CONFECTIONS are semi-solid preparations of medicinal agents preserved by means of sugar, or honey, or both. CONSERVES, as originally understood, were composed of fresh or undried, medicinal vegetables laid down in sugar. Subsequently it became common to prepare them by beating fresh vegetable medicines and sugar into a uniform soft mass, the juices of the vegetables furnishing sufficient moisture. When fresh drugs were not obtainable, dried drugs, either whole or powdered, were used, and sufficient water added to soften the mass. ELECTUARIES were understood to comprise the mixture of powdered drugs with such softening and preserving agents as honey, syrups, or pulps, made into a uniform, pasty mass by thorough trituration in a mortar. If honey and pulpy substances are employed the electuary is not apt to become dry, hard, and crystalline, as is often the case when syrups are used. Such substances as light insoluble salts, soluble salts, extracts, oils, gum-resins, etc., may be made into electuaries. Heavy insoluble powders should not be used, as they are likely to settle, and finally to be found mainly at the bottom of the preparation. Extracts to be used in preparing electuaries, should first be softened with water or other suitable liquids; non-pulverizable gum-resins should first be emulsified, and essential oils should be first rubbed with some inert powder or sugar. Freshly made electuaries should be soft enough to drop easily from a spatula. If so soft that the ingredients separate on standing they must be again brought into a uniform mixture by stirring. It is desirable that they be firm enough to hold up their several ingredients, and still be so soft that mastication is not required. As already stated, the confections displaced both these sweets (conserves and electuaries) of mediæval medicine, and very properly so, and in turn confections have given way to other and better pharmaceutical preparations.

CONFECTIO OPII.—CONFECTION OF OPIUM.

SYNONYM: *Electuarium theriaca.*

Preparation.—The *U. S. P.* of 1870 recorded the following formula: "Take of opium in fine powder, 270 grains; aromatic powder, 6 troy ounces; clarified honey, 14 troy ounces. Rub the opium with the aromatic powder, then add the honey, and beat the whole together until thoroughly mixed." This contains 1 grain of opium in about every 36 grains of the confection.

Action, Medical Uses, and Dosage.—This confection was designed to take the place of the ancient mixtures known as *Theriaca* and *Mithridatum.* It is said to be useful in debilitated conditions with *diarrhœa*, *weak digestion*, with flatulence, *gouty conditions*, and other states where a stimulating opiate is thought necessary. The dose ranges from 5 to 20 grains.

CONFECTIO ROSÆ (U. S. P.)—CONFECTION OF ROSE.

SYNONYM: *Conserve of rose.*

Preparation.—"Red rose, in No. 60 powder, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; sugar, in fine powder, six hundred and forty grammes (640 Gm.) [1 lb. av., 6 ozs., 252 grs.]; clarified honey, one hundred and twenty grammes (120 Gm.) [4 ozs. av., 102 grs.]; stronger rose water, one hundred and sixty cubic centimeters (160 Cc.) [5 fl℥, 197 ♏]. Rub the red rose with the stronger rose water previously heated to 65° C. (149° F.), then gradually add the sugar and honey, and beat the whole together until a uniform mass results"—(*U. S. P.*).

CONFECTIO SENNÆ U. S. P.)—CONFECTION OF SENNA.

SYNONYMS: *Electuary of senna, Lenitive electuary.*

Preparation.—"Senna, in No. 60 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; cassia fistula, bruised, one hundred and sixty grammes (160 Gm.) [5 ozs. av., 282 grs.]; tamarind, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; prune, sliced, seventy grammes (70 Gm.) [2 ozs. av., 205 grs.]; fig, bruised, one hundred and twenty grammes (120 Gm.) [4 ozs. av., 102 grs.]; sugar, in fine powder, five hundred and fifty-five grammes (555 Gm.) [1 lb. av., 3 ozs., 252 grs.]; oil of coriander, five grammes (5 Gm.) [77 grs.]; water, a sufficient quantity to make one thousand grammes, (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Place the cassia fistula, tamarind, prune, and fig in a close vessel with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water, and digest for 3 hours by means of a water-bath. Separate the coarser portions with the hand, and rub the pulpy mass, first through a coarse hair sieve, and then through a fine one, or through a muslin cloth. Mix the residue with one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of water, and having digested the mixture for a short time, treat it as before, and add the product to the pulpy mass first obtained. Then, by means of a water-bath, dissolve the sugar in the pulpy liquid, and evaporate the whole, in a tared vessel, until it weighs eight hundred and ninety-five grammes (895 Gm.) [1 lb. av., 15 ozs., 250 grs.]. Lastly, add the senna and the oil of coriander, and incorporate them thoroughly with the other ingredients while they are yet warm"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—When correctly prepared, this confection is a pleasant, mild, and very effectual purgative, useful during *pregnancy*, and for patients afflicted with *costiveness*, *hemorrhoids*, or *diseases of the rectum*. It forms a vehicle for the administration of some purgative drugs. The dose is from 1 to 3 drachms, or more.

CONFECTIO SENNÆ COMPOSITA.—COMPOUND CONFECTION OF SENNA.

SYNONYM: *Compound electuary of senna.*

Preparation.—Take of confection of senna 1 ounce, bitartrate of potassium ½ ounce, pulverized jalap 3 drachms; nitrate of potassium, flowers of sulphur, each, 2 drachms; extract of butternut, a sufficient quantity to form into a mass of pilular consistence. Keep in small glass jars well covered with tin foil.

Action, Medical Uses, and Dosage.—This confection has been used with advantage in *constipation* and in *hemorrhoids* of whatever form. A dose of 12 or 16 grains may be taken in pill form, repeating it twice a day, so as to act mildly on the bowels.

CONFECTIO SULPHURIS.—CONFECTION OF SULPHUR.

SYNONYM: *Electuarium sulphuris.*

Preparation.—Rub intimately together, 4 ounces (av.) of sulphur, 1 ounce (av.) of potassium bitartrate, 4 fluid ounces of syrup of orange-peel, and 18 grains of powdered tragacanth.

Action, Medical Uses, and Dosage.—This method of exhibiting the two laxatives, sulphur and cream of tartar, is beneficial in cases of *hemorrhoids*. The stools produced are semi-solid and copious. The dose is from 1 to 2 drachms.

CONFECTIO TEREBINTHINÆ.—CONFECTION OF TURPENTINE.

SYNONYM: *Electuarium terebinthinatum.*

Preparation.—Take 1 ounce of oil of turpentine, 1 ounce of powdered licorice-root, and 2 ounces of clarified honey. Rub first the turpentine and licorice together, and mix in the honey until the whole is uniformly and intimately mixed.

Action, Medical Uses, and Dosage.—This is a convenient form for administering turpentine in cases of *flatulence*, *round worms*, *rheumatic complaints*, *tympanites*, and passive *hemorrhages*. The dose ranges from 1 to 2 drachms.

CONIUM (U. S. P.)—CONIUM.

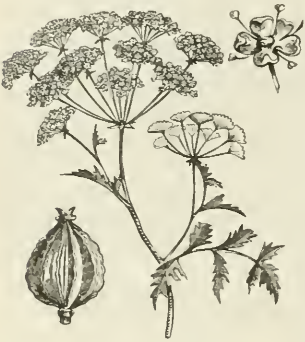
"The full grown fruit of *Conium maculatum*, Linné," "gathered while yet green"—(*U. S. P.*) (*Cicuta maculata*, Lamarck). The leaves are official in the *British Pharmacopœia*.

Nat. Ord.—Umbelliferæ.

Common Names: *Hemlock, Poison hemlock, Spotted hemlock, Poison parsley.*
Illustration: Bentley and Trimen, *Med. Plants*, 118.

Botanical Source.—Poison hemlock has a biennial, fusiform, whitish, fleshy root. Its stem is from 3 to 5 feet high, erect, round, hollow, glaucous, polished, and copiously spotted and dotted with dull purple. The leaves are tripinnate; the lower ones very large, several times pinnate, and bright-green, on long, sheathing foot stalks. The leaflets are ovate, lanceolate, pinnatifid, lower lobes incised. The flowers are numerous, small, white, all fertile, outermost very slightly irregular, and are arranged in erect, terminal, compound, many-rayed, smooth umbels. The general involucre is ovate, cuspidate, with membranous edges, consisting of from 3 to 7 lanceolate, reflected bracts, with whitish edges; the partial involucre of 3 or 4 oval, pointed, spreading bracts, with the inner side wanting. The petals are obcordate, with acute, inflected points, and 5 in number. The fruit is about a line and a half, or rather less in length, by a line in breadth; roundish-ovate, compressed, of a pale-green color; the primary ridges are elevated, sharp and undulated; the commissures and channels finely wrinkled. The whole plant exhales a disagreeable, virose odor, more especially when bruised (L.—W.).

Fig. 82.



Conium maculatum.

History.—Hemlock inhabits Europe and Asia, and has been introduced in many parts of this country. It flowers from May to August. The leaves and seeds are the parts used. The leaves are best when collected during the flowering seasons of the herb; they should be speedily dried by a gentle heat, not over 47.7° C. (118° F.), and placed in closely covered vessels, to preserve them as much as possible from the influence of the atmosphere and light. If properly dried, the leaves should have a fine green color, with a disagreeable odor, less powerful than in the fresh plant, and a peculiar, nauseous, saline, and somewhat acrid taste. The fruit, or seeds, should be gathered shortly previous to ripening. Both the leaves and seed yield their virtues to alcohol or ether. The aqueous extract is uncertain; the alcoholic extract is the best, but even this becomes destitute of coniine in a few years (P.). The *fresh* leaves and fruit should be employed in the preparation of the active constituent.

Description.—Conium (*U. S. P.*).—The fruit is thus described in the *U. S. P.*: "About 3 Mm. ($\frac{1}{8}$ inch) long; broadly ovate; laterally compressed; grayish-green; often divided into the 2 mericarps, each with 5 crenate ribs, without oil tubes, and containing a seed which is grooved on the face; odor and taste slight. When triturated with solution of potassium or sodium hydrate, conium gives off a strong, disagreeable, mouse-like odor"—(*U. S. P.*).

Conium Leaves.—(See *History* and *Botanical Source*).

Chemical Composition.—The active principles of conium are the *alkaloids*, of which 5 have been identified (C. E. Sohn, 1894, *Dictionary of Active Principles of Plants*): *Coniine* ($C_8H_{17}N$), identified with *conicine* and *cicutine*; *conhydrine* ($C_8H_{17}NO$), discovered by Wertheim, in 1856; *pseudo-conhydrine* ($C_8H_{17}NO$), isolated by E. Merck, in 1891; *methyl-coniine* ($C_9H_{19}N$); and *ethyl-piperidine* ($C_7H_{15}N$). The mixed alkaloids may be prepared by distilling a mixture of strong solution of caustic potash and alcoholic extract of the unripe fruit, whereupon they pass over, forming an oily layer in the receiver. According to directions of J. Schorm (1882) the conium fruits, moistened with water, rendered alkaline with sodium carbonate, are distilled with steam under a pressure of 3 atmospheres. The distilled oil is neutralized with hydrochloric acid, evaporated, and treated with alcohol. After removal of the alcohol on the water-bath, an equivalent amount of caustic soda is added, and the alkaloids then shaken out with ether. The ethereal solution is reduced to a low temperature, whereby the bulk of *conhydrine* separates in the form of long needles. The remaining traces will evaporate with the ether, pure *conicine* remaining (*Amer. Jour. Pharm.*, 1882).

Coniine, when pure, is an oily-like, transparent, colorless liquid, becoming brownish by oxidation, of specific gravity 0.86, with a very penetrating, tobacco-like odor, and a sharp, acrid, benumbing, and offensive taste. At ordinary temperatures it is volatile, disengaging ammonia, depositing a resinous matter, and losing its activity; its vapor excites a flow of tears. It is soluble in 90 parts of water, and forms a hydrate by uniting with about a fourth part of water, which, in cold, saturated solution, becomes turbid by heat owing to the separation of the water of hydration. It is very soluble in alcohol, ether, benzin, chloroform, benzol, the fixed and volatile oils, and also in weak acids, which it neutralizes. It boils at about 171° C. (340° F.), and distills over with water at 100° C. (212° F.). It strongly blues reddened litmus paper and forms soluble salts with acids, which, excepting the hydrochlorate, are difficult to crystallize. Caustic potash added to salts of coniine sets the base free, which is then recognized by its odor; heat produces the same effect on most of its salts. As to the behavior of coniine towards reagents, see *Amer. Disp.*, last edition; also C. E. Sohn (see above).

Coniine possesses the same remarkable action on the spinal cord as hemlock itself. A few drops will suffice to kill a cat, rabbit, or young dog; a strong cat was killed in a minute and a half by 3 drops of it. Its effects are gradual paralysis, slight convulsive tremors, and death from suspension of the breathing, without any change in the appearance of the blood, and without any depression of the heart's action.

Coniine was observed by Giesecke as early as 1827, and obtained in the form of an impure sulphate. Geiger, in 1831, obtained it pure and recognized its alkaloidal nature. It is present in all parts of hemlock, probably in combination with *malic acid* (Husemann and Hilger, 1884). It is optically active, turning the plane of polarized light to the right. Its present formula was established, in 1881, by A.W. Hoffmann, and its synthesis was accomplished, in 1886, by Ladenburg, who first prepared inactive *coniine* (*alpha-propyl piperidine* ($C_5H_9[C_3H_7]NH$), and succeeded in isolating therefrom the active alkaloid by adding a crystal of the tartrate of the dextrogyrate alkaloid to the syrupy solution of the tartrate of the inactive alkaloid.

Conhydrine ($C_8H_{17}NO$), discovered by Wertheim, is an oxyconiine occurring in commercial coniine from which it separates on cooling to near 0° C. (32° F). Its melting point is 126° C. (258.8° F.).

Pseudo-conhydrine ($C_8H_{17}NO$) was discovered by E. Merck, in 1891, in the high boiling portions of crude coniine. It crystallizes in needles, is easily soluble in alcohol, ether, and chloroform, and fuses at about 98° C. (218.4° F.). Its boiling point is 230° to 232° C. (446° to 449.6° F.).

Methyl-coniine ($C_9H_{19}N$), an oily base, and associated with coniine, was found by Von Planta and Kekulé in hemlock (1854). It is a homologue of coniine, or rather of its isomer, *paraconiine*, prepared by Schiff, in 1871. G. Liljenstroem (*Amer. Jour. Pharm.*, 1894), calls attention to the difficulty of accurately determining the quantity of the alkaloid in extract of conium by means of continuous extraction with ether, owing to the volatility of coniine, even though a reflux condenser is employed. He suggests that a known amount of centinormal acid be placed in the receiver, which readily absorbs coniine, and to titrate back the excess of acid. Wertheim obtained from fresh seeds about 0.20 per cent of pure coniine.

Action, Medical Uses, and Dosage.—Conium is narcotic, possessing, however, properties somewhat similar to those of belladonna. On account of the former difficulty in procuring good preparations of this plant, it has not been so much used nor its virtues so fully investigated, as with some of its congeners. The symptoms produced by its use are thirst, dryness of the throat, dizziness, sickness at stomach, sinking, benumbing feelings, and more or less prostration of the muscular system. If its use be continued, or in large doses, the pupils become dilated, there is a general paralysis, rendering talking and breathing difficult, with coma, or convulsions terminating in death. In about 30 minutes from its administration, its effects will generally appear, and continue from 10 to 40 hours. It is supposed to effect its results by exhausting the nervous energy of the spinal cord and voluntary muscles. It is used for promoting sleep, and will be found extremely useful in allaying excessive action of the heart in hypertrophy of this organ; a pill of 1 or 2 grains of the extract producing a calm, soothing influence, followed by a diminution or removal of the palpitation or augmented action. Indeed, all affections attended with an excited or excitable condition of the nervous and vascular systems, will be benefited by its use. Dr. J. Harley considered conium as a depressor of the muscular movements, tranquilizing and renovating the whole muscular system—being to the corpora striata, the smaller nervous centers, and the whole of the motor tract, just what opium is to the brain. It depresses the motor function of the third nerve, causing a lazy movement of the eyes, and sometimes strabismus, with imperfect adjustment of the refracting media of the eye. It affects the sedentary and strong more than the delicate and active, so that its action is influenced more by the muscular activity than by the muscular power. It has no pure cerebral effects, but diminishes irritability of the spinal cord without disturbing the sensory functions. It has no direct action on the sympathetic; improves nutrition; and can not be detected in the urine, breath, or feces. He considered it preeminently useful in *laryngismus stridulus*, *convulsive cough*, and in *tetanic muscular conditions*. The dose must be proportioned to the degree of motor activity of the child or adult; by its use we may almost measure the bodily activity of the individual. To a child 21 months old he has given 20 minims of the prepared juice, and gradually increased it to 2½ fluid drachms.

Conium has in times past been lauded in *cancer*, and, while it undoubtedly has influenced growths pronounced cancerous, it is not known to have effected a cure. The pain of cancer, however, is alleviated by it, and it undoubtedly affects *tumors of the mammæ*, even when they amount to *scirrhus*. Conium has been used to check lactation, thus showing its specific action upon the mammary glands. *Ovarian torpor*, giving rise to scanty menses, and *sterility* in the female, and in the genital feebleness of the male, accompanied with an unpleasant erethism, or where lack of sexual activity is due to passive testicular venous engorgement, conium is said to be efficient when given in small doses. *Glandular enlargements* sometimes yield to the alterative influence of this drug, and while not generally efficient in *syphilis*, as some of its admirers claim, it is useful in allaying the pains which accompany that affection. In *rheumatism* and *neuralgia*, ℞ Specific conium, gtt. v to x; aqua, fl℥iv. Mix. Sig. Dose, a teaspoonful as often as necessary, or give from ½ to 2 grains of the English extract. *Chorea* and *epilepsy*, due to sexual abuse, and *whooping-cough* and *acute mania* are states in which it is asserted useful. It has been variously used in cachectic and depraved states, either as a palliative or for its curative action. Large doses are contraindicated by debility.

In consequence of the action of conium on the spinal marrow, it lessens the venereal appetite. It likewise lessens the secretion of milk. In the *neuralgic pains* attending *carcinomatous affections* it usually gives relief, probably, from its causing relaxation of muscular fibers; sometimes, however, it has exerted no influence whatever, in palliating them. In *scrofula*, *goitre*, and, indeed, in all *tuberculous affections*, it will be found very effectual given in combination with the iodide of iron. It enters into the compound plaster of belladonna, an excellent preparation, which Prof. King used for many years. Coniine, the active principle, is not extensively used in medicine. The hydrochlorate, benzoate, and, best of all, the hydrobromate have been most used, the latter particularly in *whooping-cough* and *sciatica*. Dr. Reid gives the following formula for toothache: Take of coniine, 1 drop; rectified alcohol, essence of cinnamon, each, 4 drops. Mix. This is applied by means of a camel's hair pencil. It relieves the pain instantly, but produces no effect where the nerve is not exposed by caries; a few minutes after its application there will be vertigo, difficulty of swallowing, etc., which usually cease in about 10 or 20 minutes. It should not be too frequently, nor too largely applied. The leaves have likewise been employed externally as a poultice to *painful tumors*, *ulcers*, *neuralgic* and *rheumatic pains*, etc. For painful parts the following is useful: ℞ English extract of conium, ʒij; petrolatum, ʒvj. Mix. Apply. In *intermittent fever*, Dr. King frequently employed the following pill when quinine alone failed: Take of sulphate of quinine, 10 grains; inspissated juice of conium, 15 grains. Mix and divide into 20 pills, of which 1 pill may be given every 1 or 2 hours, until the effects of the conium have commenced, after which give 1 pill every 4 or 5 hours, according to its influence. The aqueous extract of the plant is worthless; the inspissated juice, or the ethereal extract, are alone valuable only when they are carefully and properly prepared. A strong solution of the inspissated juice, or the juice of the fresh leaves, coated over the parts daily, for 5 or 6 days, will cure the *itch*. Dose of the leaves and inspissated juice, from 1 to 3 grains, 3 or 4 times a day; of the ethereal extract, which is an elegant extract of a rich, dark-green color, from $\frac{1}{8}$ to $\frac{1}{2}$ grain; coniine, $\frac{1}{30}$ to $\frac{1}{6}$ grain; coniine bromohydrate, $\frac{1}{30}$ to $\frac{1}{6}$ grain; coniine hydrochlorate, $\frac{1}{30}$ to $\frac{1}{6}$ grain; coniine benzoate, $\frac{1}{30}$ to $\frac{1}{6}$ grain; specific conium, $\frac{1}{10}$ to 3 drops.

Specific Indications and Uses.—To relieve nervous excitation and give rest; neuralgic or rheumatic pains in the old and feeble, or where there are caco-plastic deposits; pain in stomach; pain of gastric ulcer; nervousness and restlessness.

Related Species.—*Cicuta maculata*, Linné, *Spotted water-hemlock*, *Spotted parsley*, *Spotted cowbane*, *Beaver poison*, *Musquash root*, *American water-hemlock*. North America. This plant differs from the following in having a purple-spotted stem, wider leaflets, and long, tuberous, fleshy roots. A volatile alkaloidal principle, believed to be coniine, was isolated by J. E. Young (*Amer. Jour. Pharm.*, 1855, p. 289). Mr. Glenk, in 1891, made a complete analysis of the fruit. The volatile oil was investigated recently by Mr. Stroup and found to consist mainly of terpenes (see *Amer. Jour. Pharm.*, 1894, p. 236).

Cicuta virosa, Linné (*Cicutaria aquatica*, Lamarck); *Water hemlock*, *Cowbane*.—This plant grows in wet situations from Canada north. Its rhizome is short, somewhat ovate, thick, and hollow, and has attached rootlets arranged in circles. The taste of the plant is aromatic and acrid, and its odor slightly aromatic. The plant, but not the root, as shown by Van Ankum's researches (1868), contains *cicutine*, a volatile alkaloid. *Cicutoxin* is a name applied by Boehm and Trojanowski, in 1887, to a soft, amorphous and tenacious yellow substance existing in the rhizome to the extent of 3.5 per cent. Cicuta is used as a local anodyne in *rheumatic* and *neuralgic complaints*, and *gout*. Seldom employed in medicine.

Sium latifolium, Linné; *Water parsnip.*—Europe and California. Root contains a poisonous resin, volatile aromatic oil, and a volatile base (analyzed by A. R. Porter and N. Rogers), and said to resemble the *pastinacine* of Wittstein (see *Amer. Jour. Pharm.*, 1876, pp. 348 and 483). Reputed narcotic and has been employed in *skin diseases.*

Sium lineare, Michaux, of North America, and *Sium angustifolium*, Linné, of North America and Europe, are similar plants and poisonous.

Sium nodiflorum, *Water parsnip.*—A European umbelliferous, aquatic perennial, the juice of which was found to be useful in various *cutaneous affections*, was formerly regarded as poisonous. The dose of the juice as given by Withering, however, was 3 or 4 ounces daily. It is diuretic and exerts a good influence upon *scrofulous lymphatic enlargements.* This plant is also found in the southern states.

Sium sisarum, *Skirret.*—Habitat China, cultivated in Europe, where it is eaten as a salad. Its root is sweetish and aromatic. Recommended as a diet in *pulmonic complaints.*

Ammi Visnaga, Lamarck; *Tooth-pick plant.*—South Europe, north Africa, and east Asia. This aromatic plant yields a bitter, crystalline, colorless glucosid, called *kelline*, isolated in 1878 by Ibrahim Mustapha. Th. Malosse, in 1881, found 2 per cent of an oily, acrid principle which he called *visnagol;* 3 crystalline, partly alkaloidal principles, collectively named *visnagin;* a fixed oil (10.5 per cent) containing *ammistearic acid*, etc. (*Amer. Jour. Pharm.*, 1881, p. 640, and 1886, p. 300). Kelline occasions vomiting, impeded respiration and cardiac irregularity. This plant is the *El Kellah* of the Moors. An 8 per cent decoction of the seeds, taken internally, is reputed to be a cure for troubles dependent on a uric acid diathesis, especially *rheumatism.* It relieves pain in the kidneys and urinary tract by its obtunding powers. Locally, this decoction has been applied in *rheumatism of the joints* to allay pain, and as a wash for *buccal ulcerations.*

Anthriscus Cerefolium, De Candolle (*Scandix Cerefolium*, Linné; *Chærophyllum sativum*, Lamarck); *Chervil.*—A European annual raised in gardens and used for greens. A volatile oil gives to the plant a strong, but pleasant odor, and a sharp, yet feebly bitterish taste. Externally, it has been applied to *bruises*, *swollen mammary glands*, and other local *tumefactions;* internally in *phthisis*, *scorbutus*, *scrofula*, *dropsy*, and *cutaneous disorders.* It is diuretic, emmenagogue, and deobstruent. Like other species of *Chærophyllum*, its leaves are sometimes collected for conium, though the plants do not greatly resemble each other.

CONTRAYERVA.—CONTRAYERVA.

The root of *Dorstenia Contrayerva*, Linné, and *Dorstenia brasiliensis*, Lamarck. *Nat. Ord.*—Urticaceæ.

Botanical Source.—*Dorstenia Contrayerva* is a perennial caulescent plant, with a spindle-shaped root, from which arises a stem covered with spreading, green, scaly stipules. The leaves are palmate; the lobes lanceolate, acuminate, coarsely serrated and gashed, and occasionally almost pinnatifid. The receptacle is borne on a very long stalk, and is quadrangular, waivy, or plaited. The achenia are lenticular, and imbedded in the fleshy receptacle from which they are projected with elasticity when ripe (L.). The *Dorstenia brasiliensis* closely resembles the preceding.

History and Description.—These plants inhabit the tropical parts of South America. The root, which is the part used, is knotty and ovoid, woody, 1 or 2 inches long, of a reddish-brown color externally, and pale within; its diameter is about $\frac{1}{2}$ an inch, and long, rough, slender fibers shoot out from all sides of it, especially its lower portion, and are generally loaded with small, brown knots. It has a peculiar aromatic odor, and a somewhat astringent, warm, bitterish taste, with some acridity when long chewed. As the fibers have but little odor or flavor they should be removed from the rhizome. It yields its virtues to alcohol, or water, at 100° C. (212° F.); the root abounds in mucilage; its tincture has an acid reaction on litmus.

The root of commerce is probably derived from several other species, which possess similar virtues, as the *D. Houstoni*, *D. dracena*, *D. tubicina*, and *D. opifera*. Monardes states that the word *contrayerva* is the Indo-Spanish term for alexipharmic or counterpoison.

Chemical Composition.—According to Geiger, the root contains volatile oil, starch, and a non-crystalline bitter, to which may be added resin, free acid, and woody fiber.

Action, Medical Uses, and Dosage.—Contrayerva is a gentle stimulant and a diaphoretic, and is sometimes given in *exanthematous diseases*, *typhus fever*, and *dysentery*. Its dose, in powder, is 30 grains; the best form of administration is the infusion. The Virginia snake-root is preferred to it in this country.

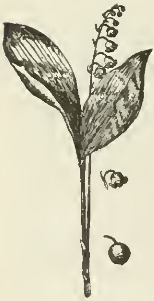
CONVALLARIA (U. S. P.)—CONVALLARIA.

"The rhizome and rootlets of *Convallaria majalis*, Linné"—(*U. S. P.*).

Nat. Ord.—Liliaceæ.

COMMON NAMES: *Lily of the valley* (*Lilium convallium*), *May lily*.

Fig. 83.



Convallaria majalis.

Botanical Source.—This plant is a low, glabrous, stemless, perennial herb, with a much-branched, slender, creeping, whitish rhizome, sending up from a bud 2, sometimes 3 oblong or ovate-elliptic leaves, the petioles of which are long and sheathing, and rolled together so as to appear stalklike. The flowers are borne on an angular scape, in the form of a raceme, and are handsome, fragrant, nodding, bell-shaped, and waxy-white in color. The perianth has a recurved lobes, and is deciduous; the stamens, 6 in number, are inserted at the perianth-base. The style is stout and single. and the stigma triangular. The fruit is a few-seeded, red berry.

History and Description.—This beautiful wild flower is indigenous to Siberia, and to a large part of Europe, from the Mediterranean northward, and is found in the mountainous woods of our own country from Virginia to the Carolinas and Georgia. It blooms in May and June. The cultivated flower is somewhat larger than that of the wild species, and is a general favorite on account of its beauty and fragrance. All parts of the plant are possessed of medicinal properties, the rhizome alone being official. It is described as follows: "Of horizontal growth and somewhat branched, about 3 Mm. ($\frac{1}{8}$ inch) thick, cylindrical, wrinkled, whitish, marked with few circular scars; at the annulate joint with about 8 or 10 long, thin roots; fracture somewhat fibrous, white; odor peculiar, pleasant; taste sweetish, bitter, and somewhat acrid" —(*U. S. P.*). The flowers have a bitter, acrid taste, and the root is best when gathered in August.

Chemical Composition.—The flowers of this plant contain a crystalline, odorous body, isolated in 1835 by Herberger. So powerful is its odor that headache is said to be induced by it. When much diluted it is extremely fragrant.

Two glucosids were found in the root and herb by G. F. Walz in 1858 (*Amer. Jour. Pharm.*, 1859, p. 557). The first is *convallamarin* ($C_{23}H_{44}O_{12}$). It occurs as a very bitter, subsequently sweetish, amorphous or imperfectly crystalline powder, insoluble in ether, but soluble in amyl alcohol and chloroform, alcohol, wood alcohol and water. Heated with diluted acids it splits into *convallamaretin* and sugar. The second glucosid is *convallarin* ($C_{34}H_{62}O_{11}$), the acrid principle, occurring in rectangular, prismatic crystals, which, although but little soluble in water, impart to the solution an acrid taste, and cause it when agitated to foam as if saponin were present. Alcohol readily dissolves it, while ether does not. Heating with diluted acids causes it to split into *convallaretin* and sugar. (See Buchner's *Rep.*, 1835, p. 397, and Husemann and Hilger, 1884.)

Action, Medical Uses, and Dosage.—In its effects upon the human circulatory system, convallaria very closely resembles digitalis, without, however, causing the unpleasant disturbances produced by the latter. Besides its effects upon the heart it acts upon the gastro-intestinal tract, producing emesis or purgation. The entire plant should be used to get the best effects, the flowers alone having been found quite inert. It seems well established that the failures attributed to this drug have been largely due to the poor preparations used, for it is certainly true that representative preparations have a pronounced action upon the economy. Convallamarin is decidedly toxic, death having promptly occurred from suspension of the heart action when introduced directly into the veins of the rabbit. The powdered flowers are sternutatory, and have been used in fomentations for the removal of *ecchymosed spots* caused by *bruises*. *Epilepsy*, *worms*, and *miasmatic fevers* have been treated with the root. The chief use of convallaria, however, is that of a heart remedy. Owing to its controlling action upon the heart it acts secondarily as a diuretic and was first employed in *dropsy* for this purpose by the Russians. Like digitalis, it is useful in those cases of dropsy where the *cardiac debility* is such that there is imperfect circulation through the organ itself, and where there is evidence of obstruction. Palpitation and irregular movements, dyspnœa, diminished renal action with increase of solids in the urine, hepatic fullness and engorgement, and œdema, are usually symptoms of this form of cardiac inefficiency. The cases of dropsy benefited, therefore, are those of cardiac origin with feeble circulation and diminished blood pressure. In small doses convallaria is a tonic to the heart, strengthening its action. *Cardiac excitation* is relieved by moderate doses, while large doses increase the heart action. Medium-sized doses are recommended in the early stage of *carditis* (Webster). *Mitral insufficiency*, with the attendant dyspnœa and palpitation, is considered as a proper condition for the exhibition of convallaria. When the favorable action upon the heart and vessels begins the heart-beats become slower, normal rhythm is established, heart power is increased, arterial pressure is augmented, respiration deepened, and the suffocative sensation, with the distressing and painful desire for air, is dispelled. Convallaria should be thought of in the *cardiac debility* following severe and exhaustive diseases, such as *typhoid fever*, *la grippe*, etc. It tends to promote a normal circulation, and relieves that sense of præcordial faintness which is apt to follow prostrating conditions. Convallaria has had no bad effects upon the cerebro-spinal tract, nor upon the digestive organs. In fact it is rather a tonic to the latter, increasing the appetite and digestive power, and acting slightly as an aperient.

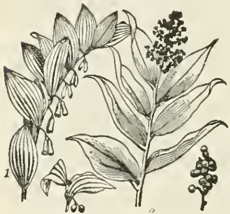
Compared with digitalis, convallaria is generally as efficient, both as a heart tonic and as a diuretic, and in many cases is said to act better. It is safer than digitalis, which may destroy life by paralyzing the heart, an effect never produced by convallaria. Moreover, it is freer from cumulative effects. Vomiting, anorexia, disordered digestion, cerebral excitation, and pupillary dilatation, in addition to its acrid taste, make digitalis often an unpleasant remedy. Convallaria is free from these objections, and may be substituted whenever the former has to be withdrawn.

It should be borne in mind that the heart irregularities benefited by this drug are not those due to organic degeneration so much as those of an obstructive character, due to mechanical causes, and particularly where the mitral valves are involved. *Insufficiency* or *stenotic conditions of the aorta* are less benefited than mitral complications. While it may be said that convallaria is never contraindicated in proper doses, it is, however, more particularly designed, according to Prof. Scudder, "to lessen the frequency of the pulse when there is an impaired capillary circulation, as shown by ecchymosis, or by the slow return of blood when it is effaced by the finger" (*Spec. Med.*). *Rheumatism*, when associated with disordered circulation, has been relieved by it. The aqueous extract of the whole plant in doses of from 15 to 20 grains a day, is said to be an efficient form of administration (Germain-Seè); the dose of the infusion of the whole plant (ʒi to water fl℥iv) is $\frac{1}{2}$ fluid ounce; of the fluid extract, 5 to 15 drops; the tincture, 5 to 30 drops; specific convallaria, 2 to 10 drops 4 times a day; convallamarin, from $\frac{1}{30}$ to 1 grain.

Specific Indications and Uses.—Heart irregularities due to mechanical impediments; mitral insufficiency; dropsy of cardiac origin; palpitation and vehement heart action, with arrhythmical movements, dyspnœa, and diminished arterial pressure. Quickened pulse with capillary obstruction.

Related Species.—*Polygonatum biflorum* (Walter), Elliott. *Convallaria biflora*, Walter. *Hairy Solomon's seal, Smaller Solomon's seal.* Formerly the species named as growing in the United States, and as being used medicinally, was indicated as *Convallaria multiflora* of Linné, or *Polygonatum multiflorum* of Desfontaines. The only species of Polygonatum, however, growing in the United States in the territory ascribed to the preceding, are the *Polygonatum biflorum*, Elliott, and the *Polygonatum commutatum* (R. & S.), Dietrich. The former is from 8 inches to 3 feet high, and has the under surface of the leaves pubescent. It thrives in woods, on high banks, hillsides, mountains, and in thickets, from New Brunswick to Ontario and Michigan, southward to Florida and West Virginia, and westward to Kansas and Texas. It blooms from April to August.

Fig. 84.



1. Polygonatum biflorum.
2. Vagnera racemosa.

Polygonatum commutatum (R. & S.), Dietrich (*Polygonatum giganteum*, Dietrich; *Convallaria commutata* [R. & S.]); *Smooth Solomon's seal, Great Solomon's seal, Giant Solomon's seal.*—A glabrous species seldom found in dry situations, but thriving in moist woods and along streams from Rhode Island to Ontario and Manitoba, southward to Georgia and Louisiana, and westward to Utah, New Mexico, and the Rocky Mountains. It blooms from May to August, and is quite variable both in size and in the form of its leaves.

Vagnera racemosa, Morong; *Convallaria racemosa*, Linné, *Smilacina racemosa*, Desfontaines); *False Solomon's seal, Spiked Solomon's seal, False spikenard.*—Common in copses in the United States. Rhizome thick, sweet, with a stem from 1 to 2 feet high, downy, and recurved at the top. Leaves from 4 to 6 inches long, about one-third as broad, oval, acuminate, veined, minutely pubescent, on petioles not exceeding 2 lines in length, often sessile. The flowers are very numerous, small, white, on white pedicels, with white, exserted, tapering filaments, constituting a large, compound, terminal raceme. Berry 3-celled, pale-red, speckled with purple, aromatic (W.—G.).

The rhizomæ of the foregoing plants are inodorous, but of a mucilaginous, somewhat sweetish taste, followed by a faint sense of bitterness.

The name *Solomon's seal* is derived from the peculiar seal-like scars left upon the rhizome by the decay of the stems of the previous year's growth. The *True Solomon's seal* is derived from the *Polygonatum multiflorum*, Allioni (*Convallaria multiflora*, Linné), and *Polygonatum officinale*, Allioni (*Convallaria Polygonatum*, Linné). Indigenous to Europe, northern Asia, and Afghanistan. Their rhizomæ and plants yielded (Walz) pectin, sugar, starch, mucilage, asparagin, and *convallarin.*

Although used with asserted benefit in several diseases by many physicians, yet the American species of these plants have received but little attention as to their true therapeutical characteristics. They are reputed tonic, mucilaginous, and mildly astringent, exerting a specific influence upon irritated and relaxed mucous membranes. Of much value in *leucorrhœa*, *menorrhagia*, *female debility*, and *pectoral affections*. In *piles*, the root chewed and swallowed, or a decoction drank as freely as the stomach will bear, will give prompt relief, or the root may be applied to the part with a similar result. An infusion of the root will be of great efficacy in irritable conditions of the intestines, as well as in *chronic inflammations* of these parts, especially when attended with burning sensations, pain, etc. In *erysipelas* and *cutaneous affections* of an erysipelatous nature, as well as those maladies of the skin produced by the *poison-vine*, or resulting from the poisonous exhalations of other plants, the decoction of Solomon's seal root will afford direct relief, and an ultimate cure. It may also be applied externally, with advantage, to *local inflammations.* A large dose of the decoction will often provoke emesis or nausea, and act as a cathartic. Dose of the decoction, from 1 to 4 ounces, 3 times daily. Solomon's seal 4 ounces, water 2 pints, molasses 1 pint, simmered down to 1 pint, then strained and evaporated to the consistence of a thick fluid extract, and 1 ounce or $\frac{1}{2}$ ounce of powdered resin mixed with it, in doses of 1 teaspoonful several times a day, forms an excellent remedy for *piles.* The rhizomæ of the various species may be used collectively under the term Solomon's seal.

Zygadenus venenosus, Watson. *Nat. Ord.*—Liliaceæ. Northwestern states. The poisonous bulb of this species, according to Watson, is known to the northern Indians of this country as *Death camass*. Violent spasms have been observed by Dr. S. H. Goodell from the ingestion of the plant. Several members of this genus are accredited with poisonous qualities.

TULIPINE.—Alkaloid of *Tulipa Gesneriana*, or *Garden tulip*. A cardiac poison with pronounced sialogogue properties.

COPAIBA (U. S. P.)—COPAIBA.

"The oleoresin of *Copaiba Langsdorffii* (Desfontaines) O. Kuntze, and of other species of *Copaiba*"—(*U. S. P.*).

Nat. Ord.—Leguminosæ.

COMMON NAMES: *Copaiba, Capivi, Balsam of copaiva, Balsam of copaiba, Balsam capivi.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 93.

Botanical Source.—The genus Copaiba is composed of handsome shrubs or trees (most of them middle or large-sized), clothed with abrupt, pinnate, leathery leaves, and adorned with apetalous blossoms borne in whitish racemes. The fruit is a coriaceous legume, containing a single seed. The official species varies considerably in the size and form of its leaflets, and may itself be only a shrub, or a small, or a very large tree. It yields the oleoresin abundantly. The substance of the literature on copaiba may be given in the following fragment of an article contributed by us to the *Western Druggist*, Feb., 1898:

History and Collection.—Copaiba (popularly known as balsam of copaiva), is obtained from South America, principally from Brazil and Venezuela, being produced by numerous species of the genus Copaifera. According to Flückiger, the following species are the principal sources of the copaiba of commerce: (1) *Copaifera officinalis*, Linné, (Guiana, Venezuela, Colombia, Trinidad); (2) *Copaifera guianensis*, Desfontaines (Lower Amazon, lower Rio Negro, Cayenne, Surinam); (3) *C. coriacea*, Martius (Bahia and Piauhy); (4) *C. Langsdorffii*, Desfontaines (continental provinces of Brazil). The number of known species has steadily increased until now the *Index Kewensis* recognizes 23 American and 5 African species.

The copaiba obtained from the vast territory of the Brazilian continent, along the Amazon and its tributaries, is collected in the shipping port of Para. Maranhao Island is also a place of export. Other shipping ports are Maracaibo and Angostura in Venezuela; Trinidad, Demerara (British Guiana), Cartagena (Colombia), and Rio de Janeiro.

As to the mode of collecting the balsam, Piso (1658) relates that an incision is made through the bark deep into the pith at the season of the full moon, which causes such an abundant flow of fatty and oily liquid that 12 pounds may exude in 3 hours. In case no oil should appear, the opening is at once closed with wax or clay, and after 2 weeks the yield is sufficient to make up for the delay. The fact that the resiniferous ducts in these trees often attain a diameter of 1 inch, as has been observed more recently by Karsten, seems to be quite in harmony with the statement regarding the abundant yield. It is also related that frequently the balsam accumulates in these ducts and exerts pressure enough upon the enclosing walls to burst the tree with a loud report. According to Piso, the copaiba tree is not very frequent in the province of Pernambuco, but thrives luxuriantly in the island of Maranhao, which he says furnishes the balsam of commerce in great quantity. He also enumerates the many medicinal virtues of the balsam, making the curious statement that its healing virtues are also experienced as an efficient means to check the flow of blood in the Jewish practice of circumcision.

Labat reports that in 1696 he had an opportunity to observe for the first time the tree yielding copaiba in the island of Guadeloupe. He relates in detail the manner of collecting the balsam which he calls *huile de copau*. The vessels in which the balsam is collected are made of the fruit of the calabash, a kind of gourd. The collection, he states, takes place about 3 months after the rainy season; that is, in March for the countries north of the equator, and in September for the countries south of this line. The balsam, he states, closes all kinds of wounds except those inflicted by gunshot. He declares it to be a powerful febrifuge, having been used with almost marvelous effect in the fever epidemics at Rennes and Nantes in 1719.

Description and Chemical Composition.—The *U. S. P.* describes copaiba balsam as "a transparent or translucent, more or less viscid liquid, of a pale-yellow to brownish-yellow color, having a peculiar, aromatic odor, and a bitter and acrid taste. Specific gravity 0.940 to 0.990 at 15° C. (59° F.). Insoluble in water, readily soluble in absolute alcohol, ether, chloroform, carbon disulphide, benzin, and fixed and volatile oils. It yields a transparent mixture with one-third of its volume of ammonia water"—(*U. S. P.*). Copaiba has the property of solidifying when triturated with 6 per cent of its weight of calcined magnesia (mass of copaiba, *U. S. P.*). According to Roussin the condition necessary to bring about solidification is the presence of water, either in the balsam or in the base. When both bodies are anhydrous the balsam remains liquid. In this connection it may be said that the process of the *U. S. P.* (and of other pharmacopœias as well), for making solidified copaiba directs the magnesia to be previously triturated with a little water. Two varieties of copaiba are distinguished in commerce; the *Para variety* from Brazil, a thin, clear, pale, aromatic, somewhat acrid and bitter fluid; and the *Maracaibo variety*, from the Antilles and the adjacent parts of the continent, a thick, golden-yellow, sometimes faintly fluorescent oil, having an odor suggestive of turpentine.

Balsam of copaiba, so-called, is not a balsam in the strict sense, for the term balsam is properly applied to such resinous exudations as contain the aromatic principles benzoic or cinnamic acid, both of which are absent in copaiba. Copaiba is an oleoresin, consisting of a volatile oil, which holds a non-volatile resin of acid properties in solution. The proportion of oil varies considerably with the different specimens, ranging from 30 to 60 per cent, sometimes being as high as 80 per cent, or even more. Both the oil and resin have been investigated (see *Oleum Copaibæ*). The residue remaining after distilling the essential oil is a hard and brittle resin which softens on warming. It dissolves in alcohol, benzin, and amyl alcohol, and consists mostly of amorphous acids. *Copaivic acid* ($C_{10}H_{32}O_2$), is a crystallizable substance which sometimes occurs as a deposit when balsam of copaiba is kept for a long time. It was first obtained by Schweitzer, in 1829. Flückiger observed a similar deposit in Trinidad balsam, from Copaifera officinalis, which he thought identical with copaivic acid. Fehling, in 1841, obtained a crystalline deposit from Para copaiva which differed from copaivic acid, and gave it the name *oxycopaivic acid* ($C_{20}H_{28}O_3$). From Maracaibo copaiba, Straus, in 1865, isolated another crystalline acid of the formula $C_{22}H_{34}O_4$, which he called *metacopaivic acid*. It melts at 205° C. (401° F.). All these crystalline, resinic acids and a peculiar principle discovered by Flückiger, have a bitterish taste. The closer chemical study of the oleoresin is beset with many obstacles, owing to the difficulty of procuring authentic specimens, as well as to the great variation in the product itself, due to its being collected from different species, or even different trees, and also to the possibility of sophistications not easily to be recognized.

Adulterations and Tests.—Probably the most frequent adulteration of the balsam is that of turpentine, which is facilitated when the pharmacopœial demand calls for the more viscid variety of the balsam. The *U. S. P.* mentions the following tests: "When copaiba is heated it should not evolve the odor of turpentine. When the volatile oil has been completely driven off by heating copaiba in a flat-bottomed capsule, the residue, when cold, should be amorphous, transparent, and friable (absence of fixed oils). Copaiba should not be fluorescent, and, when heated to 130° C. (266° F.), it should not become gelatinous. On adding 1 drop of copaiba to 19 drops of carbon disulphide, and shaking the mixture with 1 drop of a cold mixture of equal parts of nitric and sulphuric acids, it should not acquire a purplish-red or violet color (absence of gurjun balsam)"—(*U. S. P.*). The *German Pharmacopœia*, 3d ed. (additions), introduces two tests for colophony (suggested by Gehe & Co.), the second, the more sensitive, being as follows. "Expel the essential oil by heating on the water-bath, pulverize the residual resin, and dissolve 1 part in 5 parts of ammonia water. The cloudy solution should not gelatinize even after 1 day's standing." This test is said to detect about 10 per cent of colophony. See also Bosetti, *Chem. Ztg.*, 1896, p. 846.

The absence of fixed oils in copaiba is indicated, according to the *U. S. P.*, if upon complete evaporation of the volatile oil, the residue, when cold, becomes amorphous, transparent and friable. One of the direct tests for castor oil is based upon its insolubility in petroleum benzin, while copaiba, in excess of the solvent, is completely soluble, save a flocculent precipitate. However, it requires the addition of at least 10 volumes of petroleum benzin (Maisch, *Amer. Jour. Pharm.*, 1877, p. 131), for the precipitation of part of the admixed castor oil. Flückiger and Hanbury's test for the presence of castor oil is to heat the copaiba with 4 parts of alcohol (85 per cent); cool; evaporate the upper of the two layers formed, which contains alcohol, castor and essential oils, when the odor of castor oil will be evolved. If caustic lime or soda be heated with it œnanthol will be formed, which may be recognized by its characteristic odor. This will detect even 1 per cent of the adulterant (*Pharmacographia*).

Another possible (perhaps probable) admixture is that of gurjun balsam, or wood oil, obtained from various species of gigantic trees (Dipterocarpus), native to India. (According to Mr. Kebler about 30,000 pounds of gurjun balsam were imported in 1894 without any authentic information being obtainable concerning its disposition). This balsam has the property of thickening when heated to 130° C. (266° F.), especially in closed tubes. Mr. L. F. Kebler has employed with much satisfaction the following test suggested by Messrs. Dodge and Olcott, for the presence of gurjun balsam in copaiba: "Place 1 Cc. of glacial acetic acid (99.5 per cent) in a test-tube; to this add 4 drops of pure concentrated nitric acid (sp. gr. 1.42); mix well; then add to this mixture, carefully, 4 drops of the balsam in question; if gurjun balsam is present, within 5 minutes a reddish zone will appear between the layer of balsam and the acid. On mixing the contents of the test-tube well, the whole will assume a reddish or purple color." Another test, by which it is claimed that 1 per cent of gurjun balsam may be detected, is given by Ed. Hirschsohn (*Jahresb. der Pharm.*, 1895), and consists in heating a mixture of 1 volume of the balsam, 3 volumes of 95 per cent alcohol, and 1 gramme of stannous chloride. If gurjun balsam is present a pink coloration appears, becoming violet-red after ½ hour, but after 1 hour's standing its vividness disappears.

In testing copaiba the *German Pharmacopœia* (1890) introduces directions for the determination of the acid number and the ester number, calculated to detect an admixture of colophony and compound ethers (or esters).

Action, Medical Uses, and Dosage.—When given in large doses, copaiba is an irritant; in medicinal doses it is stimulant, cathartic, and diuretic; it likewise exerts an especial influence on the mucous tissues of the system, diminishing their secretions when excessive, and for this latter purpose it is principally employed. Taken internally, it causes warmth in the gastric region, with unpleasant eructations, and sometimes nausea, or even emesis. Its continued use, unless in very small doses, impairs the digestive functions. In the course of its action it becomes absorbed, so that its odor and bitter taste are communicated to the urine, while the former can also be observed in the respiration. Among the inconveniences attending its use, especially in large doses, the most frequent are sickness at stomach, emesis, hematuria, catharsis, and febrile symptoms; these effects may be obviated very often by administering the remedy more frequently, but in smaller doses, and by combining it with cinnamon, nutmeg, or some other aromatic. At times it produces a transient, papular, cutaneous affection, like the eruption of rubeola, and which is accompanied with an unpleasant formication or itching. It has been found most beneficial in chronic mucous affections, as in *chronic gonorrhœa*, *bronchitis*, *irritable conditions of the bladder*, *gleet*, *leucorrhœa*, *chronic catarrh*, *chronic diarrhœa* and *dysentery*, and *obstinate piles*. Its effects in gonorrhœa are much improved by the addition of liquor potassæ; and is much more beneficial in the gonorrhœa of males than of females, because, in the latter, the vagina is oftener affected than the urethra. However, in the urethral form it is equally as efficient in both sexes. It seems necessary that the copaiba-impregnated urine pass over the infected parts, and for that reason it is seldom as effectual in injection as when taken internally. According to Prof. F. J. Locke it has a specific influence if properly used, and that in all stages of the disease it has been used in too large doses. In the inflammatory stage of gonorrhœa, with great urethral irritation and profuse discharge, it is always contraindicated. In this acute stage he recommends the following as a sedative: "℞ Specific aconite, gtt. x; specific gelsemium, specific cannabis, aa fl℈j; simple syrup, aqua, aa q. s. fl℥iv. Mix. Dose, a teaspoonful every 3 hours, or 4 teaspoonfuls per day."

If the urination produce burning, give in a wineglassful of water from 10 to 15 grains of sodium bicarbonate, 2 or 3 times a day; if constipated, purge with compound powder of senna and jalap. Then, in the latter stage, in the absence of inflammation: ℞ Copaiba, flʒj; alcohol, fl℥j. Mix. Dose, 5 to 10 drops, 4 times a day in sugar and water. When the disease is chronic or unduly prolonged: ℞ Copaiba, sweet spirit of nitre, aa fl℥ss; liquor potassæ, essence of cinnamon, aa flʒj; mucilage of acacia, simple syrup, aa fl℥j. Mix. Dose, a teaspoonful after each meal (Locke's *Syllabus*, p. 110). However, the more recent improvements in the treatment of gonorrhœa (especially the course above pursued in the acute form), render the disease readily curable, copaiba being rarely, if ever, required to effect the cure. In injection, it has been used with fairly good results. Make an emulsion of 2 drachms of copaiba with the yolk of an egg, add 20 or 30 drops of laudanum to it, in order to prevent its too speedy discharge from the rectum, and 8 fluid ounces of water. This may be used as a rectal injection, and repeated 3 or 4 times a day. In small doses (5 drops) copaiba is useful in *chronic inflammation of the intestinal tract* with *ulceration*. Give the medicine 3 times a day. Locally, it forms an excellent application to *chilblains*, *sore nipples*, *old ulcers*, and *fistulous ulcers*, in which it serves to speedily soften the callosity of the walls of the fistulous canal. *Vesical catarrh*, *painful dysuria*, and *irritable bladder*, from excessive venery, or following gonorrhœa, are relieved by taking from 1 to 5 drops of copaiba on sugar. Inflammation of the urinary passages contraindicates its use.

Painted upon the breast in *mastitis*, and covered with oil silk, it often prevents the formation of abscesses. It has been painted upon the cheeks and temple for the relief of *purulent ophthalmia*, *syphilitic iritis*, and *sclerotitis*. *Scaly diseases of the skin* have also been influenced for good by its internal use. The dose of copaiba is from 5 to 60 drops, 2 or 3 times a day. It may be taken in emulsion, made by triturating each dose with the yolk of 1 egg, adding ½ an ounce of mint, cinnamon, or other aromatic water, and sweetening with sugar, or it may be taken in the form of pill with magnesia. The best and least objectionable form in which it can be taken is in the form of capsules. The oil (which see) is the best form for obtaining the effects of copaiba upon the respiratory tract.

Specific Indications and Uses.—Vesical pressure and tenesmus, frequent desire to urinate, the urine coming in drops; itching, burning, or smarting in urethra after urination; urethral mucoid discharges; cough, with thick tenacious expectoration, accompanied by loud mucous rales; laryngeal irritation.

Related Products.—Oleoresin of Hardwickia. This is a product of the *Hardwickia pinnata* of Roxburgh, *Nat. Ord.*—Leguminosæ, and closely resembles copaiba in taste and odor. It is, however, of darker color, and, though transparent, appears black when viewed with reflected light. It is thick and viscid, and is not fluorescent like *gurjun balsam*, and, in transmitted light, is pale yellowish-green in thin layers and wine-red in thicker layers. Broughton obtained a considerable amount of volatile oil (25 to 40 per cent), identical in composition with copaiba oil, though he failed to find copaivic acid in the resinous portion, which probably consists of two resins, one of which has acid qualities. The oil has lævogyre properties. This oleoresin comes from the East Indies, and is collected exactly like copaiba in Brazil. On applying the above pharmacopœial test for the presence of *gurjun balsam* in copaiba to the oleoresin of hardwickia, a faint greenish-yellow hue results. In India this oleoresin is employed in *gonorrhœa* with as good results as are obtained from copaiba.

Lagam Balsam (*Minjak-lagam*).—A product resembling balsamum dipterocarpi, and having a bitter, persistently acrid taste. It is of greenish cast in reflected, and transparently yellow in transmitted light. It readily dissolves in alcohol, benzol, ether, carbon disulphide, and chloroform. A lævogyre essential oil ($C_{20}H_{32}$), to the extent of ⅓ of the balsam, was obtained by G. Haussner by distillation with water. There are two resins present, one neutral and the other acid. The acid resin ($C_7H_{14}O_3$) is amorphous. When melted with caustic potash the neutral resin yields acetic, formic, butyric, and other acids and phenols. It was introduced into Europe from Sumatra, in 1854, but its botanical source is unknown (*Amer. Jour. Pharm.*, 1883, p. 369, from *Archiv. der Pharm.*, 1883).

COPTIS.—GOLD-THREAD.

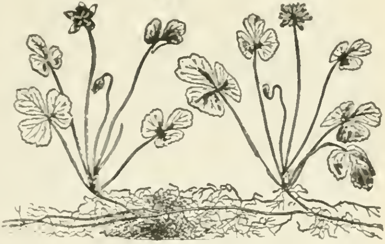
The rhizome and rootlets of *Coptis trifolia*, Salisbury (*Helleborus trifolius*, Linné).

Common Names: *Gold-thread*, *Mouth-root*, *Canker-root*.

Illustrations: Lloyd's *Drugs and Med. of N. A.*, Vol. I, Pl. 13; Bentley and Trimen, *Med. Plants*, 3.

Botanical Source.—This plant has a small and creeping, slender, thread-like, perennial rhizome of a bright-yellow color. Its leaves are ternate, on long, slender petioles, evergreen, and radical in tufts and invested at the base with a number of ovate, acuminate, yellowish scales. The leaflets are roundish, acute at base, lobed, and crenate, smooth, firm, veiny, sessile, and 4 to 8 lines long; the crenatures acuminate. The scape is slender, round, bearing 1 small, starry, white flower, and a minute, ovate, acute bract at some distance below. Petals 5, 6, or 7, inversely conical, hollow, and yellow at the mouth. Sepals 5, 6, or 7, oblong, concave, and white. Stamens numerous, white, with capillary filaments, and adnate, roundish anthers. Ovaries from 5 to 7, stipitate, oblong, and compressed. The styles are short and recurved; the stigmas acute. The capsules are stalked, oblong, rostrate, and compressed, diverging stellately, and containing many small, black, oval seeds (L.—W.).

Fig. 85.



Coptis trifolia.

History.—Gold-thread is found growing in the northern parts of the United States, following the Appalachian range as far south as northern Alabama, and in Canada, Greenland, Iceland, and Siberia. It grows in dark swamps and sphagnous woods, flowering from early in the spring to July. "Northern cedar and spruce and balsam swamps always abound with it. Another favorite habitat of the plant is the cold swamps, such as are found in mountain plateaus. It often grows freely in beds of sphagnum and other mosses, especially in wooded swamps. Although coptis is a *swamp* plant, it is not a *mud* plant, but generally selects the dry knolls surrounded by wet soil" (C. G. Lloyd, *Drugs and Med. of N. A.*, Vol. I, p. 195). At one time it was so popular as a domestic remedy that more of it was sold in Boston than almost any other indigenous drug (Bigelow). It is now but little employed. Autumn is the season for collecting coptis, when it should be dried with care. Its properties are imparted to water, but more perfectly to alcohol, and the solutions are precipitated by nitrate of silver and acetate of lead.

Description.—Coptis "appears in market as masses of the entire plant, in which the bright-yellow, thread-like rhizome preponderates, and this yellow color is often perceptible part way up the leaf-stalk. The rhizome is pure bitter to the taste (berberine), and the portion of the leaf-stalk that possesses a yellow color is also perceptibly bitter. The other portions of the plant are insipid" (J. U. Lloyd, in *Drugs and Med. of N. A.*, Vol. I. p. 198). It is also odorless.

Chemical Composition.—Coptis does not appear to contain resin, gum, gallic acid, or tannin, its virtues depending, probably, on its two alkaloids. In 1862, Prof. John M. Maisch (Buchner's *Neues Repert. of Pharm.*, Vol. XI) announced *berberine* as its bitter principle, which was later confirmed by Prof. F. F. Mayer (1863), E. Z. Gross (1873), and J. J. Schultz (1884). Prof. Mayer also announced that the berberine was associated with another alkaloid, which was afterward obtained by both Gross and Schultz, the former naming it *coptine.* C. W. Burr (1884) found starch in the rhizome, though Gross had previously failed to do so. Sugar, albumen, and silica are also present in coptis. Coptine is a white, crystalline alkaloid, existing in the plant in small quantities (see *Drugs and Med. of N. A.*).

Action, Medical Uses, and Dosage.—Gold-thread is a pure and powerful bitter tonic, somewhat like quassia, gentian, and calumba, without any astringency. It may be beneficially used in all cases where a bitter tonic is required, and is decidedly efficient as a wash or gargle, when in decoction, in various *ulcerations of the mouth.* In the *nursing sore mouth of mothers* we have repeatedly and promptly cured with the decoction when infusion of hydrastis had no effect. This would seem to indicate that its virtues are not wholly dependent upon berberine as is generally supposed. In *dyspepsia*, and in *chronic inflammations of the stomach*, equal parts of gold-thread and golden-seal, made into a decoction, with elixir vitriol added in proper quantity, will not only prove effectual, but in many instances of the latter kind, will permanently destroy the appetite for alcoholic beverages. Dose of the powder, or tincture, from ½ drachm to 1 drachm; of the decoction, from 2 to 6 fluid drachms; the tincture, made by adding an ounce of the powdered root to a pint of diluted alcohol, is preferable to the powder.

Related Species.—*Coptis occidentalis*, Torrey and Gray. This and the following plant are the more common species of Coptis found in the Rocky Mountain region and in the northwestern states, this species being found in Washington, Idaho, Oregon, and western Montana (*D. & M. of N. A.*, Vol. I, 195–197).

Coptis asplenifolia, Salisbury.—High altitudes of northern half of Montana, Idaho, and Washington, and common in West British America. This and the above species contain *berberine*, and probably possess medicinal virtues similar to those of *Coptis trifolia* (*D. & M. of N. A.*, Vol. I, 195–197).

Coptis Teeta, Wallich, *Tita.*—This drug (known in the Indian bazars as *Mishmee bitter*, is exported from China into India, where it is used as a bitter tonic, and locally in *conjunctival diseases.* The root is also used in India in *visceral obstructions, flatulence, jaundice*, and *toothache* (Dymock, *Mat. Med. Western India*).

Coptis anemonæfolia, Siebold.—Japan. Used like coptis and contains *berberine.*

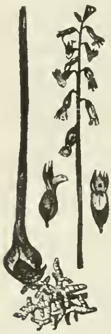
CORALLORHIZA.—CORAL-ROOT.

The rhizome of *Corallorhiza odontorhiza*, Nuttall.

Nat. Ord.—Orchidaceæ.

COMMON NAMES: *Crawley, Coral-root, Dragon's claw, Chicken-toe.*

Fig. 86.



Corallorhiza odontorhiza.

Botanical Source.—This is a singular, leafless plant, with much-branched and toothed, coral-like root-stalks. The rhizome is a collection of small, fleshy tubers, articulated and branched much like coral. The scape is from 9 to 14 inches high, rather fleshy, striate, smooth, and invested with a few long, purplish-brown sheaths. The flowers are from 10 to 20 in number, ringent, in a long spike of a brownish-green color. The lip is white, generally with purple spots, undivided, oval, obtuse, and crenulated; the spur obsolete and adnate to the globular ovary; the anther 2-lipped and terminal; pollen-masses 4, obliquely incumbent. The capsule is large, reflexed, strongly ribbed and oblong, or subglobose (G.—W.).

History.—This plant is indigenous to the United States, growing in rich woods, about the roots of trees, from Maine to Carolina and westward to the east bank of the Mississippi River, flowering from July to October. Not very common south of 35° or 36° latitude. The species *C. multiflora, C. Wisteriana, C. innata*, and *C. Macræi* probably possess similar medicinal virtues. The rhizome of the first-mentioned species (C. multiflora, Nuttall), which grows as far west as the Rockies, is undoubtedly often present in the commercial drug, and is probably as valuable. It differs from the above species somewhat, especially in having in its spike from 15 to 25 or 30 flowers, which have a deeply 3-cleft lip, and are spurred, and are succeeded by a pendulous, elliptical capsule, instead of a roundish one. The plant is also much stouter. It was first discovered in 1816, by Dr. D. S. C. H. Smith, although long known previous to that time to herbalists. The entire plant is destitute of verdure. The root is the medicinal part; it is small, dark-brown, resembling cloves or a hen's claw, has a strong, nitrous smell, and a mucilaginous, slightly bitter, astringent taste. It has not been analyzed.

Description.—The dried root, as met in commerce, is composed of small, coral-like pieces, about 2 lines in diameter, and from 3 to 12 lines long, the longest pieces consisting of the small, coral-like branches, round or compressed, crooked, wrinkled lengthwise, more or less distinctly annulated at distances varying from 1 to 2 lines, dark-brown externally, and lighter within. Its fracture is short, presenting under the microscope a shining, pulverulent, or granular appearance, somewhat like the saccharine frost on figs and raisins. The root is inodorous, with a taste sweetish at first, somewhat resembling that of raisin-seed, and succeeded by a faintly bitterish, mucilaginous flavor.

Action, Medical Uses, and Dosage.—Crawley is probably the most powerful, prompt, and certain true diaphoretic in the materia medica, but its scarcity and high price prevent it from coming into general use. It is also sedative, and promotes perspiration, without producing any excitement in the system. Its chief value is as a diaphoretic, in *fevers*, especially *typhus*, and in *inflammatory diseases*; it has proved efficient in *acute erysipelas*, *cramps*, *flatulency*, *pleurisy*, and *night-sweats;* and relieves *hectic fever* without debilitating the patient. Probably it will be found to combine tonic, sedative, diaphoretic, and febrifuge properties. When, in *acute pulmonic troubles*, a non-stimulating diaphoretic is needed, we can employ none better than the coral-root. To "break up a cold" it is one of the most certain of medicines. It is fully equal to asclepias, and lacks the dangerous features of jaborandi. It has done excellent service in *diphtheria*. *Acute* and *chronic pleurisy* are both conditions in which it will prove curative. Years ago it was used for the control of *colliquative sweating of phthisis*, and will be found equal to muscarine and salvia for this purpose. It is one of the best remedies ever employed for the general debility preceding pulmonic affections. We have employed tincture of coral-root in cases where all the symptoms were those of incipient consumption, with the most beneficial results. There is hacking cough, loss of weight, want of appetite, pleuritic pains, and marked general prostration. The remedy will be found slow, but certain in its action. From 3 to 5 weeks will be required before any good results can be observed. The appetite is the first to respond, the cough and pain cease, there is increased urinary product, and the functions of the skin are better performed. The patient increases in strength and flesh, and all the unfavorable symptoms disappear. It has been employed in dry *bronchial irritation* with "tightness across the chest, wheezing, and severe paroxysms of irritable cough," and in one case where enlarged thyroid caused mechanical bronchial irritation, the physician was successful in removing the condition by the reduction of the size of the *goitre* with this agent. It should be employed either in infusion or tincture, and the doses should be moderately large and long-continued. The infusion is prepared by taking $\frac{1}{2}$ ounce of the root to 1 gallon of water, and the patient is to drink freely of it. Or a saturated alcoholic tincture, or a saturated rye-whiskey tincture, may be given in $\frac{1}{2}$-drachm doses 3 or 4 times daily. Its virtues are especially marked in the low stage of *fevers*. The dose is from 20 to 30 grains of the powdered root, given in water as warm as the patient can drink, and repeated every 1 or 2 hours, according to circumstances. The powder should always be kept in well-closed vials; it formerly constituted the "*fever-powders*" of some practitioners. Combined with extract of blue cohosh it forms an excellent agent in *amenorrhœa* and *dysmenorrhœa;* and is unsurpassed in *after-pains*, *suppression of lochia*, and the febrile symptoms which sometimes occur at the parturient period. In fevers it may be advantageously combined with specific leptandra, or resin of podophyllum, where it is found necessary to act upon the bowels or liver; and mixed with specific dioscorea, it will be found almost a specific in *flatulent* and *bilious colic*.

Specific Indications and Uses.—General prostration, malaise, hacking cough, loss of appetite, loss of weight, pleuritic pains, bronchial irritation, pyrexia.

Related Species.—As there was formerly some doubt as to the true plant which furnishes the crawley root, and, as Prof. King, in his first edition of the *American Dispensatory* (which he corrected, however, in a subsequent edition), described it as the *Pterospora Andromedea*, it may not be out of place to give a description of the latter. In many respects these plants resemble each other, as will be seen by the following description:

Pterospora Andromedea, Nuttall. *Albany beech-drops*, *Pine-drops.*—It belongs to the *Nat. Ord.*, Ericaceæ. It is a rare and singular plant, found on barren hills and shady uplands, and in a hard clay soil in the State of New York, and some of the northern states and Canada, flowering in July. It has a perennial, fleshy, tuberculous root, with many tubers which resemble the claws of a fowl. Stem or scape erect, simple, straight, dark-purple, cylindrical, covered with short viscid wool, from 8 to 30 inches in height, leafless, and sparsely beset with scales. Leaves none. Flowers pale or reddish-white, lateral, nodding, disposed in a terminal raceme from 6 to 12 inches long, composed of 50 or more flowers; pedicels irregularly scattered, from 6 to 8 lines in length, axillary to long, linear bracts. Calyx 5-parted; corolla roundish-ovoid, urn-shaped; limb 5-toothed, reflexed, inclosing the stamens. Stamens 10; filaments flat, anthers peltate, 2-celled, 2-awned, opening lengthwise; style short; stigma 5-lobed, capitate. Capsules or pod globose, depressed, 5-lobed, 5-celled, loculicidal. Seeds very numerous, minute, ovoid, tapering to each end, the apex expanded into a broad, reticulated wing, many times larger than the nucleus (G.—W.). It was discovered near Albany, N. Y., in 1817, by Dr. Edwin James, who regarded it as a *Monotropa*, and as such, on authority of Dr. Torrey, was designated by Amos Eaton (*Man. of Bot.*, 2d ed.), under the name *Monotropa procera*.

CORDIALE RUBI FRUCTUS (N. F.)—BLACKBERRY CORDIAL.

Formulary number: 28.

Preparation.—"Blackberry juice, eighteen hundred and seventy-five cubic centimeters (1875 Cc.) [63 fl℥, 192 ♏]; cinnamon, in No. 40 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; cloves, in No. 40 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; nutmeg, in No. 40 powder, twenty-five grammes (25 Gm.) [386 grs.]; diluted alcohol (*U. S. P.*), a sufficient quantity; syrup (*U. S. P.*), eighteen hundred and seventy-five cubic centimeters (1875 Cc.) [63 fl℥, 192 ♏]. Percolate the powdered spices with diluted alcohol to obtain twelve hundred and fifty cubic centimeters (1250 Cc.) [42 fl℥, 128 ♏] of tincture, and add to this the blackberry juice. Then add thirty grammes (30 Gm.) [1 oz. av., 25 grs.] of purified talcum, set the mixture aside for 24 hours, occasionally shaking, and filter. Wash the filter with sufficient diluted alcohol to obtain thirty-one hundred and twenty-five cubic centimeters (3125 Cc.) [105 fl℥, 321 ♏] of filtrate; lastly add the syrup, and mix well"—(*Nat. Form.*).

Prof. Maisch used precipitated calcium carbonate instead of talcum, and suggests that as the syrup is apt to become turbid after standing, it should be filtered before dispensing, but in our opinion this should not be done. We have known blackberry cordial to become a gelatinous magma.

Action, Medical Uses, and Dosage.—This is a popular remedy for *diarrhœa*, and may be given in doses of ½ to 1 fluid ounce.

CORIANDRUM (U. S. P.)—CORIANDER.

"The fruit of *Coriandrum sativum*, Linné"—(*U. S. P.*).

Nat. Ord.—Umbelliferæ.

COMMON NAMES: *Coriander, Coriander fruit.*

Botanical Source.—Coriander is an annual, smooth herb, with a tapering root, and a round, erect stem, 12 or 18 inches high, more or less branched, leafy, round, and striated. The leaves are compound; the lower ones pinnate, on long, slender petioles, their leaflets wedge-shaped, or fan-shaped, acutely notched; upper leaves multifid, in fine, linear segments. The flowers are white, often with a reddish tint, disposed in compound, terminal, stalked umbels, of rarely more than 4 or 5 rays; the partial rays being more numerous. The calyx is 5-toothed, acute, unequal, and permanent. Petals obovate, emarginate, with inflexed lobes, the exterior radiating and bifid. The fruit is spherical, a line and a half in diameter, somewhat coriaceous, carminative, and aromatic. The seed is excavated in front and has a loose skin (L.)

History.—Coriander is an Italian plant, but introduced in all the warmer portions of Europe and temperate parts of Asia, flowering from May to July, and maturing its fruit early in the latter part of summer. Occasionally it is found in cultivation in the United States and South American States. When the fresh plant is bruised, it emits a disagreeable, bedbug-like odor, but by desiccation the fruit acquires its peculiar aromatic odor. The pleasant flavor is owing to a volatile oil, which may be procured by distillation. Alcohol takes up the active properties of the seed, water only partially.

Description.—"Globular; about 4 Mm. (⅙ inch) in diameter; crowned with the calyx-teeth and stylopod; brownish-yellow, with slight, longitudinal ridges; the two mericarps cohering, enclosing a lenticular cavity, and each furnished on the face with two oil-tubes; odor and taste agreeably aromatic"—(*U. S. P.*).

Chemical Composition.—The fruit contains a volatile oil, its chief constituent (see *Oleum Coriandri*), tannin, malic acid, mucilage, and a large quantity (about 13 per cent) of fatty material. The amount of ash was found to be 5.21 per cent (*Amer. Jour. Pharm.*, 1887, p. 28).

Action, Medical Uses, and Dosage.—Coriander is a stimulant and carminative, and is employed in medicine as an adjuvant or corrigent. Its dose is from 20 to 60 grains.

CORIARIA.—CURRIER'S SUMACH.

The leaves of *Coriaria myrtifolia*, Linné (*Rhus Coriaria*, Linné).

Nat. Ord.—Coriariaceæ.

COMMON NAMES: *Myrtle-leaved coriaria, Currier's sumach.*

Botanical Source.—This is a low, unarmed shrub of the Mediterranean regions. The leaves are opposite, entire, lanceolate, acute, short petiolate, and prominently 3-veined. The flowers are small, inconspicuous, in erect, terminal racemes. The sepals are 5, and imbricated in the bud. Petals 5, fleshy, gland-like and shorter than the calyx. The carpels are 5, distinct, and each is furnished with a long, thick, exserted stigma, which protrudes from the bud, and forms the most conspicuous part of the flower. The fruit is a small, black berry, not larger than a common pea.

History.—This shrub grows in Mediterranean Europe and Asia, and has been cultivated in gardens for ornamentation and for the leaves, which yield a black dye. The leaves have likewise been employed to adulterate senna—a dangerous fraud, as, according to Dr. Masters, they have caused convulsions and subsequent coma. The most distinctive characteristic is to be found in the *three* prominent veins of the leaves, whereas senna leaves have but one. The fruit of this shrub is poisonous, having proved fatal to French soldiers at Catalonia, who ate of it.

Description.—Coriaria leaves are from 1 to 1½ inches in length, smooth, entire, ovate-lanceolate, of a shiny bluish-green above, paler beneath, marked by a prominent mid-rib and two lateral nerves running near the border of the leaf nearly to the apex. They have an acrid, bitter, and very astringent taste.

Chemical Composition.—The leaves contain a poisonous bitter principle, investigated by Riban (1865), and named *coriamyrtin* ($C_{30}H_{36}O_{10}$). It is obtained by precipitating the aqueous extract of the leaves with subacetate of lead; filtering, treating the filtrate with sulphide of hydrogen; filtering again, and evaporating the filtrate to a syrupy consistence, from which substance ether dissolves the coriamyrtin; it may subsequently be purified by recrystallization from alcohol. It is a neutral, white body, very bitter, forming in from 4 to 6-sided prisms, which are soluble in 70 parts of cold and slightly more soluble in boiling water; are very soluble in boiling and in 50 parts of cold alcohol, also soluble in ether, chloroform, and benzol, but only slightly so in carbon disulphide. Dilute acids split it into a substance resembling sugar, and a resin (Husemann and Hilger, *Pflanzenstoffe*, 1884). In addition to this principle, the leaves contain tannin and are used for tanning leather and dyeing black. For microscopical tests for coriamyrtin, see T. F. Hanausek, *Amer. Jour. Pharm.*, 1893, p. 135.

Action, Medical Uses, and Dosage.—Both the leaves and berries are poisonous. M. Riban gave about 3 grains of the bitter principle to a large dog, and, although it was immediately ejected, horrible convulsions occurred in about 20 minutes, followed by death in 75 minutes; 1 grain of coriamyrtin killed rabbits, and the subcutaneous injection of $\frac{3}{16}$ of a grain killed a rabbit in 25 minutes. The symptoms following its administration to these animals were rapid succussions of the head extending to all the limbs, clonic and tetanic convulsions coming on in paroxysms; contractions of the pupils, trismus, and foaming at the mouth; the animals died from asphyxia and nervous exhaustion. Autopsy revealed vessels gorged with brown blood, coagulated in the cardiac cavities, the pulmonary artery, and the inferior vena cava; brown patches on the lungs; injection of the meninges; rapid cadaveric rigidity. No irritating action appeared upon the digestive tube. In cases where children have accidentally eaten the fruit, the symptoms have been a condition like that occasioned by alcohol (drunkenness), aphasia, frothing, purplish countenance, nausea, vomiting, convulsions, and death in from 15 to 20 hours. The plant has not yet been employed in medicine. The New Zealanders have a *toot-poison*, which is very destructive to human and animal life, and which, it is stated, is procured from *Coriaria sarmentosa*, Forster. *Coriaria ruscifolia* is also reputed poisonous.

CORNU CERVINÆ USTUM.—BURNED DEER'S HORN.

Preparation.—Take the horns of the deer (*Cervus virginianus*) any time from the month of August to December, or from the time they are *in velvet* (until just before they fall off), and when dry rasp them to a coarse powder. Place this in an iron vessel, cover it tightly, and put it in an oven, or other situation, where a strong heat can be gradually and increasingly applied. When the whole becomes of a light-brown color, like roasted coffee, and is readily pulverizable, cool, pulverize it, and keep it in well-stoppered bottles. During the application of the heat, which should be gradual, the powder should be occasionally agitated. The powder, thus prepared, is of a light chocolate, or brown color, of a peculiar, slightly aromatic, animal charcoal odor, and a very faintly astringent taste. During the operation disagreeable fumes are evolved.

Action, Medical Uses, and Dosage.—A powerful styptic. Especially an American remedy, of much value in *uterine hemorrhage* and *menorrhagia*. Has also been found beneficial in *dysentery*, *hemoptysis*, and other *hemorrhages*. Dose of the powder, 1 drachm, every ½ hour, until the hemorrhage ceases permanently, which is usually from the first to the third or fourth dose; or 1 drachm of the powder may be placed in a gill of hot water, and a tablespoonful of the infusion be given every 5 or 10 minutes. It is often given combined with the compound powder of ipecacuanha and opium, or with other agents, as capsicum and opium, etc.

CORNUS.—DOGWOOD.

The bark and bark of the root of *Cornus florida*, Linné

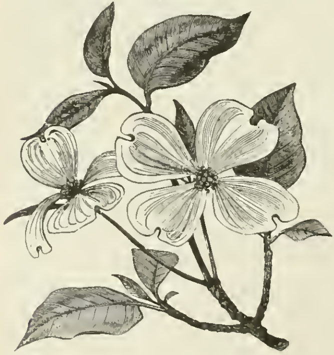
Nat. Ord.—Cornaceæ.

Common Names: *Dogwood, Flowering dogwood, Flowering cornel, Boxwood.*

Illustrations: Bentley and Trimen, *Med. Plants*, 136; Johnson, *Med. Bot. of N. A.*, Pl. 5.

Botanical Source.—Dogwood is a small, indigenous tree, from 12 to 30 feet high, with a very hard and compact wood, covered with a rough, brownish bark, much broken. It is a tree of tardy growth. The branches are opposite, spreading, smooth, and covered with a reddish bark, marked with rings at the place of the former leaves. The leaves are opposite, but partially expanded at the flowering time, ovate, acute, entire, petiolate, nearly smooth, dark-green and grooved above, and paler beneath, and marked with strong parallel veins. The flowers very small, of a greenish-yellow color, in heads or sessile umbels, upon peduncles an inch or more in length, surrounded by a large involucre, constituting the chief beauty of the tree when in flower. The involucre is composed of 4 white, nerved, obovate leaves, having their point turned abruptly down or up, so as to give them an obcordate appearance. The calyx is superior and campanulate, with 4 obtuse, spreading teeth. The corolla is composed of 4 oblong, obtuse, reflexed petals. Stamens 4, erect; anthers oblong, with filaments inserted in their middle. Style shorter than the stamens, erect, bearing an obtuse stigma. The fruit is an oval drupe of a glossy scarlet color, containing a nut, or nucleus, with 2 cells and 2 seeds (L.—W.).

Fig. 87.



Cornus florida.

History.—Cornus florida grows in various parts of the United States, but more abundantly in the middle states. It flowers in April and May, sometimes earlier and sometimes later than this, depending upon the climate. The fruit matures in autumn. This is one of the most conspicuous and handsome of our native trees when in bloom, and is frequently cultivated for its singular beauty. Its leaves turn red in the autumn. The wood is very compact and hard, and capable of receiving a high polish, and may be employed for many purposes. The American Indians extracted from the twigs and roots of this and other species a scarlet coloring matter for dyeing purposes. Dogwood bark was used considerably during the American Revolution as a substitute for Peruvian bark.

Description.—The bark of the stem, branches, and roots, is the medicinal part. That from the root is the best. It is found in commerce in broken fragments, somewhat quilled, ¼ or ⅙ of an inch in thickness, ash-colored, with a reddish tinge, very friable, and very readily reduced to a powder of a similar color; it has but little odor, and its taste is astringent and feebly aromatic. Its properties are taken up by water or alcohol.

Chemical Composition.—Geiger, in 1836, obtained from the bark of the root a bitter principle (*cornine*), in pure form, and he proved that Carpenter's cornine is a mixture of calcium salts and the bitter *cornine* discovered by himself. Geiger's process is essentially as follows: Make a cold aqueous extract of the root-bark, shake with freshly prepared hydroxide of lead, filter, evaporate to dryness, abstract with absolute alcohol, filter again, add ether to turbidity, filter, and allow to evaporate spontaneously. *Cornine* crystallizes in silky needles, is soluble in water and alcohol, but sparingly soluble in ether. Its aqueous solution is precipitated by basic, but not by neutral, acetate of lead; also by silver nitrate. Tannic acid, mercuric, ferric, and barium chlorides are without effect upon it (Husemann and Hilger, 1884). Prof. Maisch, in 1859, showed that cornine is liable to be decomposed by exposure to heat or the atmosphere. The bark was found by H. K. Bowman (1869) and Chas. F. Kramer (1882) to contain 3 per cent of tannin (*Amer. Jour. Pharm.*).

Action, Medical Uses, and Dosage.—Dogwood bark is tonic, astringent, and slightly stimulant. It forms an excellent substitute for Peruvian bark, having frequently proved efficient in *periodic attacks* when the foreign drug failed. It may be used in many cases where quinine is indicated and can not be administered, owing to idiosyncrasy, etc. It may be used with advantage in cases where tonics are required, in *periodical fevers*, *typhoid fevers*, etc. Its internal employment increases the strength and frequency of the pulse, and elevates the temperature of the body. It should be used in the dried state, as the recent bark is apt to derange the stomach, and cause more or less pain in the abdomen, but which may be removed by 10 or 15 drops of laudanum. It is useful in *headaches* from quinine, in *general exhaustion* and *pyrosis*. An extract of the bark prepared by boiling it in water, and evaporating to the proper consistence, will be found one of the best forms in which to administer it. Dose of the powdered bark, from 20 to 60 grains, as often as required; of the extract, from 5 to 10 grains. The ripe berries formed into a tincture with brandy or whiskey, are a popular bitters among some country people; the flowers are occasionally used in the place of chamomile. Specific cornus, 1 to 20 drops.

Specific Indications and Uses.—"Tonic and antiperiodic; intermittent or miasmatic fevers; pyrosis; headache from quinine; general exhaustion" (Scudder); feeble, relaxed tissues; pulse feeble and temperature subnormal; quinism.

Related Species.—*Cornus sericea*, Linné. *Swamp-dogwood*, *Kinnikinnik*, *Rose-willow*, *Red-osier*, *Silky cornel*, *Red-willow*. This is a shrub from 6 to 10 feet high. Stems several, erect, with a dark-red or purplish bark, and opposite, spreading branches, with downy twigs. Leaves opposite, from 2 to 4 inches long, half as wide, ovate, acuminate, varying from ovate and oval to lanceolate, nearly smooth above, with rather prominent veins, with a brown, silky down underneath, on petioles, from half an inch to an inch long. Flowers yellowish-white, small, disposed in large, terminal, depressed and woolly cymes or corymbs. Berries globose, bright-blue; stone compressed (L.—W.). Swamp dogwood is found in moist woods, and on the margins of rivers, from Canada to Carolina, flowering in June and July. The bark is the official part, that of the root being preferred. It resembles the bark of the following species (*C. circinata*) though it is not so warty and has a purplish tint. It possesses properties similar to to those of *Cornus florida*, being, however, more astringent and less bitter. It has been found useful in *dyspepsia* and *diarrhœa*, and, in the same doses, may be employed as a substitute for the *C. florida*, and administered in a similar manner. An infusion is valuable in checking *vomiting*, especially that common to *pregnancy* and *disease of the uterus*. It has also been highly recommended in *dropsy*, *ulcers*, *malignant fevers*, and as an antiseptic.

Cornus circinata, L'Heritier. *Round-leaved dogwood, Broad-leaved dogwood, Alder-leaved dogwood, Round-leaved cornel.*—A shrub growing from 6 to 10 feet high, with straight, slender, greenish and verrucose branches. Leaves large, about as broad as long, orbicular, or very broadly oval, opposite, acuminate, waved on their edges, somewhat rough above, downy beneath. Flowers white, in small, spreading, depressed cymes, without an involucrum. Fruit, or berries, a bright-blue, becoming lighter colored as they ripen, small, soft, hollowed at base, and crowned with the persistent style (W.—G.). This plant is found in North America from Canada to the Carolinas, and west to Missouri, growing on river banks, copses, and elevated ridges, and flowering from May to August. The dried bark is usually greenish or grayish-white and warty when from young twigs, brown-gray from old branches, with shining-brown confluent verrucæ, short, cylindrical, or semi-cylindrical pieces, having a slight odor, and a somewhat aromatic, astringent, and bitterish taste. It imparts its virtues to water, and, in chemical character, has thus far been found similar to Cornus florida (R. Gibson, 1880). An astringent tonic, which may be employed in all cases where such agents are indicated. An infusion of it may be made by infusing an ounce of the coarsely-powdered bark in a pint of boiling water, and may be given in doses of 1 or 2 fluid ounces, several times a day. It is useful in *diarrhœa* and *dysentery*, and also as a gargle in *sore throat*. One ounce of the bark affords 150 grains of an astringent, intensely bitter extract, which may be used with benefit. The medicinal virtues of the plant, as well as its doses, are similar to those of *Cornus florida*.

Specific Indications and Uses.—Bitter taste, aversion to food, continual nausea, indigestion. Tincture (℥viii to dilute alcohol Oj) 20 to 60 drops, 3 times a day.

CORYDALIS.—TURKEY-CORN.

The tubers of *Dicentra Canadensis*, De Candolle (*Bicuculla Canadensis* (Goldie), Millspaugh; *Corydalis formosa*, Pursh; *Corydalis Canadensis*, Goldie).

Nat. Ord.—Fumariaceæ.

COMMON NAMES: *Turkey-corn, Squirrel-corn, Wild turkey-pea, Stagger-weed.*

Botanical Source.—This is an indigenous perennial plant, from 6 to 12 inches in height, and having a root-stalk bearing many small deep-yellow round tubers, about as large as peas. The leaves are ternately compound, with stalked divisions, incisely dissected into linear or oblanceolate segments, and decidedly glaucous underneath. The scape is slender and naked, rises from 8 to 12 inches in height, and bears a simple raceme of from 4 to 8 flowers, which are cordate-ovate, 5 lines broad at base and 7 to 9 lines long, short-petioled, nodding, greenish-white tinged with purple, and somewhat fragrant. The spurs or nectaries are short and rounded. The fruit is a many-seeded pod-like capsule.

History.—This beautiful little plant has been considerably employed in medicine. It flowers very early in the spring, in this section of the country as early as March; and the root or tuber, which is a small, round ball, should be collected only while the plant is in flower. It grows in rich soil, on hills and mountains, among rocks and old decayed timber, and is found westward and south of New York to North Carolina. It must be distinguished from the *Dicentra* (*Corydalis*) *Cucullaria*, which flowers at the same time, and very much resembles it.

Description.—The root or tuber of the *Dicentra Canadensis* (C. formosa, Pursh) when fresh is of a darkish-yellow color throughout, while the Dicentra Cucullaria (C. Cucullaria), or *White ear-drop* has a black cortex or rind, and is white internally. When dried, the external covering of the tuber is of a light grayish-yellow color, about ¼ of a line thick, inclosing an internal light-yellow substance; frequently it is of a dark color externally, and internally yellow or brownish-yellow. It has a faint peculiar odor, and a taste at first slightly bitter, succeeded by a somewhat, penetrating, peculiar, and persistent sensation, which gently influences the fauces, and increases the flow of saliva. Water or alcohol extracts its virtues.

Chemical Composition.—The only analysis we find on record of this species of Corydalis (*C. formosa*, Pursh), is that of Mr. William T. Wenzell (*Amer. Jour. Pharm.*, 1855, Vol. 27, p. 207), who found the root to contain *corydaline*, fumaric acid, yellow bitter extractive, acrid resin soluble in alcohol or ether, containing volatile oil, tasteless resin, soluble in alcohol and insoluble in ether, brown coloring matter, starch, albumen, bassorin, cellulose and cortical substance, and inorganic salts. The alkaloid *corydaline* occurs in several species of Corydalis, and was discovered in 1826, by Wackenroder, in the root of *Corydalis cava*, Schwgg. (*C. tuberosa*, De Candolle). It crystallizes in white prisms or fine needles, which melt at 135° C. (275° F.). It is odorless and tasteless in substance, but its alcoholic solution or the solutions of its salts are bitter. It is not soluble in water, soluble with difficulty in alcohol, soluble in ether, chloroform, amyl alcohol, carbon disulphide, benzol, and turpentine. Its solution in alcohol has a strongly alkaline reaction. The formula for *corydaline* has been variously stated by different authors as $C_{18}H_{19}NO_4$ (Wicke), and $C_{22}H_{27}NO_4$ (Dobbie and Lauder, *Jour. Chem. Soc.*, 1892). Adermann's corydaline (*Amer. Jour. Pharm.*, 1890, p. 396) ($C_{22}H_{21}NO_4$), is probably not identical with the body long known by that name. The alkaloids of *Corydalis cava* have been investigated more closely than the others. E. Merck (*Archiv. der Pharm.*, 1893, p. 131), reports the occurrence of the following: *Bulbocapnine*, crystallizable, was present in largest quantity; fuses at 199° C. (390.2° F.); *corydine*, an amorphous alkaloid; *corydaline*, the alkaloid of Dobbie and Lauder, fusing at 135° C. (275° F.), and a base melting at 218° C. (424° F.). The last alkaloid is probably not identical with Freund and Josephy's *corycavine*, isolated in 1893, together with *bulbocapnine*, from commercial corydaline. For Adermann's investigations, see *Amer. Jour. Pharm.*, 1890, p. 396. The preparation sold under the name CORYDALIN, as an old Eclectic concentration, is a mixture of corydalis constituents. It has a dark yellowish-brown color, and not being a definite, proximate principle, should not be confused with the alkaloids.

Action, Medical Uses, and Dosage.—This agent is peculiar to Eclectic practitioners, and was formerly much employed by them. It is tonic, diuretic, and alterative. In all *syphilitic affections*, it is an excellent tonic and alterative; and will likewise be found valuable in *scrofula*, and in many cases where tonics are indicated. As a tonic, it possesses properties similar to gentian, calumba, or other pure bitters; its alterative properties, however, render it of much value. In *syphilis*, especially in the constitutional form, when occurring in debilitated or broken-down constitutions, its efficacy is not equaled by any other agent as an alterative tonic; but from considerable experience with it, I am by no means satisfied that it exerts any real influence as an antisyphilitic, properly so-called, as has been heretofore believed (King). On the other hand, Webster and others regard it as a very valuable remedy in the disorders depending upon syphilis and *scrofula*, in the former comparing its action to that of *Berberis aquifolium*. It is claimed to be a remedy for *syphilitic nodes*, and particularly when they are recent. The tibia and the skull bones seem to be chiefly impressed by it. The *periosteal shin pains* of syphilitics are said to be promptly alleviated by corydalis. In *syphilitic ulcerations* the drug should be given internally, and an infusion used locally. Prof. Locke recommends it in *amenorrhœa*, *dysmenorrhœa*, and *leucorrhœa* in atonic cases with a scrofulous or syphilitic diathesis. Also as a tonic to the digestive organs with enlargement of the abdomen due to atony, and declares it excellent in *dysentery* and *diarrhœa* with coated tongue, fetid breath, and poor digestion. It is likewise of value in the cachexia following *miasmatic fevers*. Dose of the infusion, from 1 to 4 fluid ounces 3 or 4 times a day; of the saturated tincture, from ½ to 2 fluid drachms; of corydalin, from ½ to 1 grain 3 or 4 times a day. The infusion to be made of 4 drachms of the powdered bulb and 1 pint of boiling water. Specific corydalis, 10 to 60 drops. Webster expresses the hope that the Eclectics will not let the homœopaths discover this remedy anew.

Specific Indications and Uses.—Syphilitic or scrofulous diathesis; yellow skin with lymphatic enlargements; syphilitic nodes. Increases waste and improves nutrition.

COTO.—COTO BARK.

The bark of an undetermined South American tree.

History.—Coto bark is exported from the interior of Bolivia, but the tree from which it is derived is unknown. (The bark of *Palicurea densiflora*, Martius, is known in Brazil under the name *Coto-coto*). In 1875, Dr. Wittstein received a few pounds for chemical examination, with the statement that it was produced by a species of Cinchona; this was disproved, however, by Harz, after a microscopic examination. In this country, coto bark and not *Para-coto bark* (see below), in substance, in tincture, or in fluid extract, is always used in medicine.

Description.—Coto bark reaches us in pieces of from 4 to 12 inches in length, 2 to 4 inches in width, and from ½ to ⅘ inch in thickness; the outer or corky portion is about $\frac{1}{18}$ of an inch in thickness, dark-brown internally, rusty upon the inner surface, and externally grayish-brown or blotched with spots of white. The surface is somewhat rough. Beneath the thin cork it is of a dark-cinnamon color; fibrous upon its inner surface and intermixed with some granular matter; but, toward the outer part the granular matter increases in proportion until the reverse is true. Its fracture presents very numerous points of a golden yellow. The odor of the bark is aromatic, especially when freshly broken, reminding one of mace or of a mixture of mace and cinnamon. The taste is intermediate between that of mace and allspice, finally becoming acrid and biting. The dust is irritating when inhaled.

Chemical Composition.—Dr. Wittstein found this bark to contain a pale-yellow, aromatic, volatile oil, of less density than water, and biting to the taste; a volatile alkaloid resembling propylamin, and two resins, besides a tannin, starch, formic, butyric, and acetic acids, etc. In 1876, Jobst obtained a crystallizable body, *cotoin*, possessing the biting taste peculiar to the bark, and which he supposed represented its medicinal virtues. Cotoin was obtained by exhausting the powdered bark with cold ether, distilling the greater part of the solvent, treating with light petroleum benzin, 6 parts (which caused the precipitation of a copious amount of resin), and evaporating the benzin solution to the point of crystallization. Afterward, by the same process of isolation, he found another crystalline, but non-pungent body in another sample of bark (since named Paracoto bark), and named it *paracotoin*. Still further examinations by Jobst and Hesse gave conflicting results, and later researches by the same chemists demonstrated that the discrepancies were due to the fact that two barks were upon the market under the name *coto*, and that only to the first, that examined by Wittstein, should the term (coto) be applied; Para-coto bark being accepted as the name of the second (see *Related Drug*).

Coto bark, according to the investigations of Jobst and Hesse (Lieb. *Annal.*, Vol. 199, 1879, pp. 17–96; also see *Amer. Jour. Pharm.*, 1880, pp. 20–28), contains *cotoin* and *dicotoin*, the latter occurring in the mother liquors from the preparation of cotoin, and being regarded as its anhydride. Cotoin forms square prisms of a light yellowish-white color, having an intensely biting taste, and melting at 130° C. (266° F.). The dust of cotoin causes violent sneezing and coughing. It is soluble in alcohol, ether, acetone, chloroform, carbon disulphide, and boiling water, and nearly insoluble in cold water. It is soluble in alkalies and alkaline carbonates, being again precipitated by mineral acids, and even carbonic acid gas. Its aqueous solution reduces gold and silver salts in the cold, and exhibits some characteristic color reactions with nitric and sulphuric acids, ferric chloride, etc. Its formula is $C_{22}H_{18}O_6$, and tribromine- and triacetyl substitution products were obtained by the authors.

Action, Medical Uses, and Dosage.—Coto bark, in the form of powder, tincture, or extract, has been successfully employed in *diarrhœa;* M. von Gietl considered it a specific in the several forms of diarrhœa. Burkhart and Rieker have found it to possess extraordinary virtues in *intestinal catarrh*, *diarrhœa*, and *dysentery*. Good results are obtained from it in some cases of *cholera infantum*, and strong endorsement has been accorded it as a remedy to control the *colliquative sweats of phthisis*. It has likewise been employed beneficially in *colic*, *dental nervous pains*, in *gout*, and in *rheumatism*. The tincture made by percolating 1 part of the coarsely powdered bark with 9 parts of alcohol, may be given in doses of 10 drops, repeated every 2 hours; the powder, in doses of $\frac{1}{2}$ grain, repeated 4, 5, or 6 times a day. The effects of the tincture and the powder are, however, very disagreeable, owing to the essential oil and the resinous principles present in them, producing a persistent, burning taste in the mouth, with increased flow of saliva, a burning sensation in the stomach, with eructations and vomiting, on which account the active principle, cotoin, has been substituted, as it does not occasion these unpleasant symptoms, and is fully as efficient. Cotoin is especially useful in cases in which opium and its preparations are contraindicated; its dose is very small, thus: In 4 fluid ounces of distilled water dissolve $\frac{7}{10}$ of a grain, or $1\frac{1}{2}$ grains of cotoin, and to this add 10 drops of alcohol and 1 ounce of syrup. The dose is a tablespoonful every 1 or 2 hours.

Related Drug.—Para-coto Bark. Para-coto bark resembles coto bark in its general appearence, but has a much weaker odor, and only a faintly pungent, acrid taste. It reaches market under the name *Coto*, and is packed in exactly the same manner, thus, it is said, rendering its substitution in commerce frequent. The principal constituents are, *paracotoin*, which crystallizes from an ethereal tincture of para-coto bark, in yellowish scales, and has the composition $C_{19}H_{12}O_6$. Solution of hydrate of potassium, or of sodium converts it into *paracotoic acid* ($C_{19}H_{14}O_7$). *Leucotin*, a substance crystallizing in white prisms, is present in larger proportion, and is obtained by agitating the crystalline mass resulting from evaporation of the tincture of para-coto bark with glacial acetic acid. The leucotin dissolves in the acetic acid, and may be purified by recrystallization from hot diluted alcohol. Its composition is $C_{34}H_{32}O_{10}$. *Oxyleucotin* is obtained from the alcoholic mother liquor, after separation of paracotoin, and has the composition, $C_{34}H_{32}O_{12}$. An agreeable volatile oil was also obtained by distillation of the bark with superheated steam, colorless, specific gravity 0.9275, and separable into 5 distinct compounds by means of fractional distillation, with boiling points ranging from 160° C. (320° F.) to 242° C. (467.6° F.). In addition to the foregoing, several other products were identified, *e. g.*, *dibenzoyl hydrocotoin* ($C_{32}H_{32}O_8$), *hydrocotoin* ($C_{15}H_{14}O_4$), and *piperonylic acid* ($C_8H_6O_4$), and we refer the reader, if interested, to the original article, or the abstracts published in the *Amer. Jour. Pharm.*, and in *New Remedies*, January, 1880 (see under *Coto Bark*; also see Ciamician and Silber, *Chem. Centralbl.*, 1892. Vol. I, p. 751).

COTULA.—MAY-WEED.

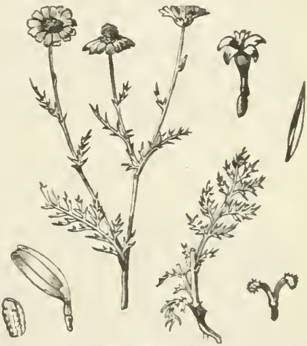
The whole herb *Maruta Cotula*, De Candolle (*Anthemis Cotula*, Linné; *Maruta fœtida*, Cassini).

Nat. Ord.—Compositæ.

COMMON NAMES: *May-weed*, *Wild chamomile*, *Dog fennel*, *Dog chamomile*.

Botanical Source.—Maruta Cotula has an annual, twisted, tapering, fibrous root, with one or more stems, erect, branched, bushy, leafy, angular, furrowed, nearly smooth, and solid, from 1 to 2 feet high. Its branches are corymbose. The leaves are alternate, sessile, bright-green, smooth, or slightly hairy, bipinnatifid, and cut. The segments are narrow, flat, a little succulent, spreading, rather distant, not crowded or parallel, and somewhat bristle-pointed. The flower-heads are solitary, on terminal, striated, slightly downy peduncles. The involucre is more or less hairy, its scales almost equal, obtuse, and slightly bordered. The disk is convex, lemon-colored, with the slender bristle-shaped, or subulate, greenish scales not quite so tall as the opening florets. The rays are white, elliptical, 3-toothed, deflexed, and close to the stalk, at night. The receptacle is highly conical, almost cylindrical, and beset with slender, permanent scales. The seeds are brown, obovate, furrowed, and sometimes rough, with minute tubercles (L.).

Fig. 88.



Maruta Cotula.

History.—May-weed is indigenous to Europe, and is common in this country, where it is known as *Wild chamomile*, *Dog fennel*, etc. It may be found growing in waste places, in hard, dry soils, especially along roadsides. Its flowers are white, and appear from June until September. Every part of the plant is acrid and fetid, and, according to Linnæus, is grateful to toads, and is annoying to fleas and flies. The whole plant is medicinal. Its taste is bitter and pungent; water or alcohol extract its properties.

Chemical Composition.—Mr. W. H. Warner found it to contain oxalic, valerianic, and tannic acids, coloring matter, albumen, acrid oleoresin, insoluble bitter extractive, volatile oil, and various salts (*Amer. Jour. Pharm.*, Vol. XXX, p. 390). From an analysis, in 1859, Pattone announced an alkaloid under the name *anthemidine*, and a crystallizable acid, of a bitter taste, and soluble in ether and alcohol, to which the name *anthemidic acid* was given.

Action, Medical Uses, and Dosage.—Tonic, emetic, antispasmodic, emmenagogue and epispastic. The cold infusion or extract may be substituted, as a tonic and antispasmodic, in all cases, for the foreign article. The extract may be used in *sick headache*, and in convalescence from *fevers*. A warm infusion may be used as an emetic or diaphoretic. It has been efficient in *amenorrhœa.* The fresh plant bruised and applied to the skin, will cause vesication, and the sores heal readily. A powerful epispastic is made by preparing the fresh leaves of *M. Cotula* and *Polygonum punctatum*, equal parts, and moistening them with a small quantity of spirits of turpentine. Dose of the infusion, from 1 to 4 fluid ounces, as often as required.

COTYLEDON.—NAVELWORT.

The plant *Cotyledon Umbilicus*, Linné (*Umbilicus pendulinus*, De Candolle).

Nat. Ord.—Crassulaceæ.

COMMON NAMES: *Pennywort, Navelwort, Cotylet.*

Botanical Source.—A succulent, herbaceous perennial, having an erect stem about 6 inches in height, arising from a tuberous, fleshy root. The leaves are small, peltate, concave, fleshy, and somewhat rounded, with a repand-crenate border, the upper leaves being smallest. The flower-stem bears a profusion of small pale or greenish-yellow, and bell-shaped, pendulous, tubular flowers arranged in a spike.

History and Chemical Composition.—This succulent perennial is indigenous to England and south and west Europe. It inhabits old rocks, stony ruins, and sandy situations, growing on dry banks. When dried, the plant is odorless, and possessed of a mucilaginous taste. If the plant be powdered and exposed to the air, it acquires a peculiar, fish-like odor, probably due to *trimethylamine*, which it has been found to contain. It also contains an ammonium salt, potassium nitrate, salts of potassium, sodium, calcium, oxide of iron, mucilage, cellulose, tannin, yellow coloring principle, chlorophyll, a volatile oil, and 95 per cent of water (fresh plant).

Action, Medical Uses, and Dosage.—This plant was formerly bruised and applied to *contused wounds.* At one time it acquired a reputation, in England, as a remedy for *epilepsy*, but, after an extended trial, was discarded as worthless. Its composition is such that possibly the plant is not wholly inert. The fresh juice may be administered in doses of from ½ to 1 fluid ounce, 3 times a day.

CREOSOTUM (U. S. P.)—CREOSOTE.

"A mixture of phenols, chiefly guaiacol and creosol, obtained during the distillation of wood-tar, preferably of that derived from the beech, *Fagus sylvatica*, Linné (*Nat. Ord.*—Cupuliferæ)"—(*U. S. P.*).

SYNONYMS: *Creasotum, Creasote.*

History and Preparation.—Creosote was discovered by M. Reichenbach in 1830. It exists in impure pyroligneous acid, and in the tar obtained by the distillation of wood, the latter yielding it in the greatest quantity. As regards the spelling of the word *creosote* (the *British Pharmacopœia* prefers the spelling *creasote*), see Chas. Rice in *Amer. Jour. Pharm.*, 1894, and Jos. Ince, *Pharm. Jour.*, 1895, p. 305). Briefly creosote is prepared as follows (see Prof. S. P. Sadtler, *Indus. Org. Chem.*, 189):

The lower, tarry layer resulting from the destructive distillation of wood (see *Acidum Aceticum Pyrolignosum*) furnishes the material from which creosote is obtained. By distillation and rectification the tar is differentiated into an aqueous distillate containing wood spirit and pyroligneous acid, an oily distillate lighter than water, another distillate heavier than water, and the residual pitch. The creosote oils constitute the fraction of the heavier distillate collected between 150° and 250° C (302° and 482° F.). These oils are abstracted by means of solution of caustic soda, which separates the aqueous, creosote-bearing layer, from which the addition of sulphuric acid liberates the creosote. The oils are then further purified by distilling with steam, and finally rectifying in glass retorts. Creosote oils from wood-tar contain a little phenol (carbolic acid), which is more abundant in coal-tar creosote. Creosote contains the higher phenols and their methyl ethers, *e. g.*, *guaiacol* ($C_6H_4[OCH_3].OH$), *creosol* ($C_6H_3.[CH_3].[OCH_3].OH$), *xylenol* (*phlorol*) ($C_6H_3[CH_3]_2.OH$), *methyl-creosol*, etc. Max Pfrenger (*Archiv. der Pharm.*) examined a certain specimen of *birchwood creosote*, and found it to consist of *guaiacol* and *creosol* in largest quantity, of *cresol* and *xylenol* (the homologues of phenol), in smaller amount, while phenol (carbolic acid) could not be identified.

Description.—The official creosote is "an almost colorless, yellowish or pinkish, highly refractive, oily liquid, having a penetrating, smoky odor, and a burning, caustic taste; usually becoming darker in tint on exposure to light. Specific gravity, not below 1.070 at 15° C. (59° F.). Soluble in about 150 parts of water at 15° C. (59° F.), but without forming a perfectly clear solution. With 120 parts of hot water it forms a clear liquid which, on cooling becomes turbid from the separation of minute oily drops. The filtrate from this yields a reddish-brown precipitate with bromine T.S. (distinction from carbolic acid). Soluble, in all proportions, in absolute alcohol, ether, chloroform, benzin, carbon disulphide, acetic acid, and fixed and volatile oils. It begins to boil at about 205° C. (402.8° F.), and most of it distills over between 205° and 215° C. (401° and 419° F.). When it is cooled to —20° C. (—4° F.), it becomes gelatinous, but does not solidify (difference from carbolic acid). It is inflammable, burning with a luminous, smoky flame. Creosote is neutral or only faintly acid to litmus paper"—(*U. S. P.*). When concentrated it destroys the epidermis, dissolves iodine, phosphorus, sulphur, and black oxide of copper, reduces oxide of mercury at a boiling temperature, and dissolves the coloring matter of indigo, which is precipitated on the addition of alcohol and water. It also dissolves camphor and many of the resins. An aqueous solution preserves meat, which has been dipped into it. Concentrated nitric and sulphuric acids decompose it.

Tests.—Creosote from wood-tar is liable to be adulterated with crude carbolic acid, or it may even be totally substituted by it. F. B. Eisenhart (*Amer. Jour. Pharm.*, 1886, p. 593), showed that of 15 specimens analyzed, 8 were carbolic acid. In another instance (*Massachusetts Health Report*, see *Amer. Jour. Pharm.*, 1886, p. 111), the extent of substitution was approximately 60 per cent. Creosote is sometimes impure by reason of the presence of some of the other principles (indifferent oils) formed by the destructive distillation of wood. Since pure creosote is completely soluble in concentrated acetic acid and solution of caustic potash, while the above adulterations rise to the top of the solution, this treatment affords a ready means of separation. If creosote leaves a stain on paper not removable by heat, it contains a fixed oil.

Besides, the Pharmacopœia gives the following tests: "On mixing equal volumes of creosote and collodion in a dry test-tube, no coagulum should form. If 1 volume of creosote be mixed with 1 volume of glycerin, a nearly clear mixture will result from which the creosote will separate on the addition of 1 or more volumes of water. On adding to 10 Cc. of a saturated, aqueous solution of creosote 1 drop of ferric chloride T.S., the liquid will acquire a violet-blue tint which rapidly changes to greenish and brown, with formation, usually, of a brown precipitate. (The preceding 3 tests show difference from and absence of notable quantities of carbolic acid). On mixing 2 Cc. of creosote with 8 Cc. of a 7.5 per cent solution of sodium hydrate, a clear, pale yellowish liquid results, which becomes turbid when diluted with water, but clears up after 50 Cc. have been added (absence of neutral oils). If 1 Cc. of creosote be mixed with a warm, 20 per cent solution of potassium hydrate in absolute alcohol, a solid, crystalline mass will form upon cooling. If 1 Cc. of creosote be shaken with 2 Cc. of benzin and 2 Cc. of freshly prepared barium hydrate T.S., upon separating, the benzin should not be blue or muddy, and the aqueous layer should not have a red tint (absence of cœrulignol and some other high-boiling constituents of wood-tar)"—(*U. S. P.*). For a valuable paper on the distinctive tests for carbolic acid, cresylic acid (cresol), and creosote, by Alfred H. Allen, see *Amer. Jour. Pharm.*, 1879, p. 28–36.

The above-mentioned ferric chloride test, while very sharp for carbolic acid alone (in the quantities above indicated, it yields, with coal-tar acids, a permanent violet-blue coloration), can not be used to identify carbolic acid when mixed with creosote. Flückiger's test is said to overcome this difficulty (*Amer. Jour. Pharm.*, 1892, p. 195). In principle it is as follows: 4 Cc. of creosote are mixed with 1 Cc. of ammonia water, the mixture heated to 60° C. (140° F.), spread in a flat-bottom dish to form a thin layer, and the vapors of bromine brought in contact with it. Pure creosote yields a brown color, turning green, while carbolic acid forms a deep blue. For the valuation of *guaiacol* in creosote consult the same reference.

Action, Medical Uses, and Dosage.—Creosote, when applied to the mucous tissues, or to the denuded cutis, occasions sharp, burning pain, and if the article be the commercial variety, which generally contains carbolic acid, it coagulates the albumen of the tissues and may cause ulceration of the part. The action of creosote closely resembles that of carbolic acid, and, in view of the fact that a large part of so-called creosote employed in medicine is carbolic acid, many of the effects attributed to the former are those previously described under the latter agent. Creosote may be absorbed when applied to ulcerations, so that poisonous effects may be experienced. Taken internally to excess, pain in the abdomen, with bloody discharges, may occur, and fatal cases show destructive lesions of the parts over which the creosote has passed. As high as 500 drops of creosote have been taken in 24 hours, which goes to prove that, when pure, its physiological effects must be different from those of carbolic acid, the action of which it has always been thought to resemble, and the range of application of the two agents have been considered very similar. Its antiseptic power is fully equal to, if not superior, to that of phenol. A thorough investigation of the action of creosote has not as yet been made. Anatomical specimens may be kept in an aqueous solution of creosote, equally as well as in alcohol. Moldiness in ink may be prevented by the addition of a few drops of creosote to it; it is also added to preservative fluids for microscopical preparations for the same purpose. Creosote protects wood against most of the attacking insects, as the marine teredo, and the land white ant; also from moisture, fungi, and animal and vegetable life, and prevents dry rot and other species of decay. Probably carbolic acid would answer a better purpose in these several instances. Commercial creosote (holding carbolic acid) forms a gelatinous compound with $\frac{2}{3}$ its weight of collodion; this is not the case with pure beech-tar creosote.

A poisonous dose of creosote occasions dimness of vision, fixation of the eyes, vertigo, diminution of the action of the heart, coma, and often convulsions. The treatment must be ammonia and stimulants to counteract the depression of the vital powers, the soluble sulphates with white of egg, oleaginous and mucilaginous drinks.

Creosote is irritant, styptic, antiseptic, narcotic, escharotic, and probably diuretic. Internally, in small doses, it is sedative and anæsthetic. It is used in *diabetes mellitus*, *epilepsy*, *hysteria*, *neuralgia*, *chronic catarrh*, *hemoptysis*, *hematemesis*, *chronic gonorrhœa* and *gleet*, and to arrest *nausea* or *vomiting* occasioned by *hysteria* or *pregnancy*, but further and more accurate investigations are required before we can positively determine its value in these affections when internally administered. Its value in vomiting is enhanced by its property of partially paralyzing the sensitive gastric nerve filaments, and, like carbolic acid, it is undoubtedly of marked value in *yeasty* or other *fermentation* of the contents of the stomach. As early as 1833, Reichenbach claimed creosote as a remedy for *phthisis*. Following him came Elliotson (1834), Carmack (1836), and others, who made similar claims, but the remedy failed to find favor and its use for this purpose was dropped, to be revived again by Imlay, in 1876, since which time its use in this country has amounted to "a fad" with certain practitioners. Imlay only employed it by spray. It is, however, again fast losing ground as a remedy for consumption, the relief in cases apparently benefited now being attributed largely to the use of restoratives employed with it and the hygienic precautions observed. Even those who made a large use of it, upon the ground that it would destroy the tubercle bacillus, now admit that it possesses no such power, and that it does not in any way benefit the consumptive patient. On the contrary, when long taken, the patient becomes possessed of a disgust for medicine and food, while gastro-intestinal irritation is so far produced as to induce nausea, vomiting, and diarrhœa, with the consequent nervous depression resulting from such a state.

Externally, as more commonly used, it has been found efficient in *scaly cutaneous affections*, *burns*, *external wounds*, *capillary hemorrhage*, *indolent* and *gangrenous ulcers*, also *scrofulous*, *syphilitic* and *fistulous ulcers* and *scrofulous ophthalmia;* as a gargle, in *putrid sore throat*, as an injection, diluted with oil of almonds, in *chronic suppuration of the external meatus of the ear*, and it is one of the most effective applications in *toothache*, depending on exposure of the nerve. A saturated solution of camphor in creosote, applied by means of camel's hair pencil slightly moistened with it, has been efficient in *gangrene of the mouth.* Creosote should most usually be sufficiently diluted, and used in the form of mixture, solution, or ointment. Dose, from 1 to 3 drops, diluted with 2 or 3 fluid ounces of weak aromatized mucilage, 3 or 4 times a day. When employed in phthisis it is generally given with cod-liver oil, wine and gentian, etc.

Creosote water (see *Aqua Creosoti*) has been used as a local application in various ways to stimulate *indolent ulcers* and *abscesses*, to neutralize bad odors, and to stimulate mucous tissues, as of the mouth and throat. Internally, from ½ fluid drachm to 3 or 4 fluid drachms of aqua creosoti may be given for a dose. For inhalation, take 1 part of creosote to 3 of alcohol.

Related Bodies.—Creosotum Carbonicum. A transparent, yellowish-brown, honey-like body, without odor, and having a feebly bitter taste, has been introduced under this name as a remedy for *phthisis.* It is soluble in the fatty oils, but not in water. By the action of alkalies, and when within the system it undergoes decomposition into carbonic acid gas and creosote. As much as 75 grains have been given in a day (Chaumier, 1892).

Creosotal is the name given to the carbonate of creosote, containing 90 per cent of pure creosote and rich in guaiacol. For its properties and uses, see *Amer. Jour. Pharm.*, 1894, p. 40.

CRETA PRÆPARATA (U. S. P.)—PREPARED CHALK.

Formula: $CaCO_3$. Molecular Weight: 99.76.

Synonym: *Creta lævigata.*

Source.—Chalk is an impure calcium carbonate, a substance that exists widely distributed over the globe, and constitutes a large share of the rock formations of the earth. It occurs in various modifications, *e. g.*, in the form of limestone, marble, calc-spar (Iceland spar), and aragonite. It is the basic substance in coral, and crustacean and mollusk shells. The bones and teeth of man and animals, and the solid portion of egg-shells, are composed chiefly of calcium carbonate. It is frequently found in pathological conditions of the human system, such as calcifications, and occasionally as renal calculi. The so-called *otoliths* in the internal ear of the human species are crystallized calcium carbonate. Chalk in quantities has not been found in the United States, but is obtained in abundance in the south of England, where it forms the immense chalk cliffs of the English channel, and along the adjacent coast of France. It occurs in the newest secondary strata, and constitutes, with its subordinate rocks, a distinct and peculiar formation. It is scarcely ever a perfectly pure calcium carbonate, always containing silica, alumina, iron, and fossil remains of land and marine animals, in great quantity, *e. g.*, the shells of Foraminifera of microscopic size. Chemically it is impure carbonate of calcium, and is identical with marble (which see) in its relations to water, air, alcohol, heat, and acids.

Chalk is termed by some writers *native friable carbonate of lime.* There are two kinds, *hard* and *soft chalk;* the latter is commonly preferred for medicinal purposes, though the former may be employed as well. It has an earthy appearance, white when pure, grayish-white or even reddish, when impure, inodorous, tasteless, opaque, insoluble, giving a sensation of roughness when touched, very friable, with an earthy fracture, leaving a white mark when drawn over a resisting surface, and having the specific gravity 2.3 to 2.7. Chalk is completely dissolved by hydrochloric acid, with the exception of the silica present; if this solution contains alumina, the addition of ammonia will cause a white precipitate; if it contains oxide of iron the precipitate will be in yellow-brown flakes.

Preparation.—Chalk should not be employed as a medicine until it has been divested of its gritty particles by levigation and elutriation, as follows: Rub chalk into a paste, with a little water. Stir this into a large quantity of water, and when the coarse particles have subsided, pour off the supernatant turbid liquor, and let it settle. Decant the water, and dry the powder upon some flat, porous body. Molded it forms, when dried, conoid or pyramidal figures, which are known as prepared chalk. *Whiting* is chalk freed from its silicious particles. A finer grade, soft and smooth, is known as *Paris* or *Spanish white*; this when mixed with pigments, forms the basis of *pastel pencils.*

Description.—Creta Præparata (*U. S. P.*). "A white, amorphous powder, often molded into conical drops, odorless and tasteless; permanent in the air.

Almost insoluble in water; insoluble in alcohol. Soluble in diluted acetic, hydrochloric, or nitric acid with copious effervescence, but without leaving more than a trifling residue. When heated to redness, prepared chalk loses carbon dioxide and is converted into lime"—(*U. S. P.*).

Tests.—"The solution in diluted acetic acid yields, with ammonium oxalate T.S., a white precipitate insoluble in acetic, but soluble in hydrochloric acid. If from the solution in diluted acetic acid the calcium be completely removed by precipitation with ammonium oxalate T.S., in slight excess, the filtrate should not be rendered very turbid upon addition of sodium phosphate T.S. and a little ammonia water (limit of magnesium). Another portion of the solution in acetic acid should not assume more than a slight bluish tint upon addition of potassium ferrocyanide T.S. (limit of iron). Another portion of the same solution should not be rendered turbid by the addition of barium chloride T.S. (absence of sulphate). In another portion of the solution no precipitate should occur upon the addition of potassium dichromate T.S. (absence of barium)"—(*U. S. P.*). Prepared chalk has been largely adulterated with, or entirely substituted by calcium sulphate (powdered gypsum). The latter is whiter than prepared chalk, which has a grayish cast. Gypsum does not effervesce when treated with acids; the substitution may thereby be at once recognized.

Action, Medical Uses, and Dosage.—Antacid, astringent, and absorbent. The animal cretaceous products probably act more kindly upon the stomach. Used in *acidity of the stomach* and *acid diarrhœa*, combined with aromatics and opium; externally to *ulcers* and *burns*, to absorb the *ichorous discharges*, and to prevent *excoriation* from pressure or friction. Dose, from 10 grains to 1 drachm.

Related Drugs.—Testa Præparata, *Prepared oyster shell.* The prepared shell of the *Ostrea edulis*, Linné. *Class*, Acephala; *Order*, Lamellibranchia; *Family*, Ostracea. This product, but little used at the present time, was official in the *U. S. P.* of 1870. Its chief constituent is calcium carbonate, which is present to the extent of from 87 to 98 per cent, being contained in greater proportion in the internal pearly layer of the shell. Calcium phosphate, silica, and other earthy substances form the remainder of the inorganic material. The organic matter may amount to from 0.5 to nearly 5 per cent.

Calcaréa Carbonica or *Calcarea Ostrearum* (Hering), is essentially the same as **Testa Præparata**, and is a standard remedy among Homœopathists. The original process of preparation as pursued by Hahnemann, was to break clean, thick oyster shells into small pieces, and after carefully selecting fragments of the inner, snow-white portion, to powder them. This was then used in making triturations. Prof. H. T. Webster is a strong advocate of the use of this remedy in *strumous conditions* with faulty action of the lymphatic glands. Lack of bone nutrition resulting in *rickets* and the *head sweating* of debilitated infants, are positive indications for it. *Mucorrhœa*, or copious muco-purulent discharges as in *bronchorrhœa*, and in *chronic post-nasal inflammations* and *chronic pharyngitis*, marked results are claimed by this author, who also employs it in *non-irritative vaginal* and *uterine leucorrhœa* due to relaxed tissues. In *lung affections* and *chronic coughs* it is adapted where there is but little inflammation or fever. Chronic cases are best treated with it. It is said to be a positive agent in some cases of recent *goitre*. Webster employs the 3 x trituration in doses of 1 to 3 grains 3 or 4 times a day. Prof. Scudder gives as the specific indications for calcarea carbonica enlargement of lymphatic glands; pallid, inelastic skin; softness of tissues; diseases of the reproductive apparatus of women, with these symptoms (*List of Spec. Ind.*).

Os Sepiæ, *Cuttlefish bone.*—The chalk-like bone found in the mantle of the *Sepia officinalis*, Linné. *Class:* Cephalopoda. Collected principally in the Mediterranean waters. This bone is white, calcareous, oval-oblong, convex on both surfaces, a portion of it being porous and easily broken, while the back part of the surface is hard, glossy, and smooth. Although containing minute quantities of calcium phosphate, the bone is chiefly made up of calcium carbonate (80 to 85 per cent); organic, gelatinous matter amounting to from 10 to 16 per cent is also present. Cuttlefish bone is largely used to furnish calcium carbonate to cage-birds.

Corallium.—*Coral.* The calcareous skeleton of *Corallium rubrum*, Lamarck (*Isis nobilis*, Pallas and Linné), and *Oculina virginea*, Lamarck. *Class:* Polypiphera. Corals inhabit the bottom of some parts of the sea, and consist of branching skeletons, covered with pulpy animal tissues. These chalk-like skeletons were formerly employed in medicine for the same purposes as calcium carbonate, but are now chiefly collected as ornaments. The first species is of a dull-red color, while the second is milky-white, the color of the former being due to ferric oxide, which is present to the extent of nearly 5 per cent. The skeleton contains a variable and small quantity of animal matter, a little magnesium carbonate, but is mostly composed of calcium carbonate. The Homœopaths use corallium rubrum in doses of 2 or 3 drops of the 6 x dilution, 2 or 3 times a day, in *convulsive* and *nervous coughs*, not originating in the pulmonic tissues. Webster claims good results from it in *whooping-cough*.

Lapides Cancrorum, *Lapilli cancrorum*, *Calculi cancrorum*, *Oculi cancrorum*, *Crab's eyes*, *Crab's stones.*—Calcareous concretions found in the stomach of *Astacus fluviatilis*, Fabricius (*Class:* Crustaceæ), or *Crawfish.* These bodies are composed of about 64 per cent of calcium carbonate, about 16 per cent of calcium phosphate, small amounts of other salts, and the remainder of animal matter. They are circular, plano-convex, and have a concentric furrow on their flat surface. They range from ⅛ to ½ inch in diameter, the cross section exhibiting a series of concentric layers. They effervesce in hydrochloric acid, in which they do not completely dissolve, thus being distinguished from spurious crab's eyes, which are wholly dissolved by that acid. In the presence of boiling water crab's eyes assume a pinkish-red hue.

CHELÆ CANCRORUM, *Crab's claws.*—Finely powdered *crab's claws* were formerly employed medicinally as an antacid and absorbent. They contain calcium carbonate, 60 parts; calcium phosphate, 14 parts; and of organic matter, 26 parts.

Other Calcium Compounds.—CALCII BENZOAS ($Ca[C_7H_5O_2]_2.3H_2O$), *Calcium benzoate.* To a hot solution of benzoic acid add calcium carbonate in slight excess, filter, and evaporate to crystallization. Handsome radiating, tuft-like crystals, soluble in cold (1 in 18), and in boiling water (1 in 6). Used in 10-grain doses in *struma, incipient hepatic cirrhosis, scrofulous conditions*, and *uric acid diathesis.*

CALCII HIPPURAS ($Ca[C_9H_8NO_3]_2.3H_2O$), *Calcium hippurate.*—Prepare like the preceding, using hippuric acid in place of the salicylic acid. It resembles calcium benzoate.

CALCII HYPOSULPHIS ($CaS_2O_36H_2O$), *Calcium hyposulphite, Calcium thio-sulphate, Calcium sulpho-sulphate.*—The hyposulphites closely resemble the sulphites in therapeutic action. They are more stable than the latter and easily dissolved by water. Upon adding an acid to their solutions, sulphur is precipitated. They are generally prepared by heating sulphur with a sulphite or bisulphite, in the presence of water. Hyposulphite of calcium may be prepared by boiling together lime (40), sulphur (400), and pure water (400), filtering, and then passing washed sulphur dioxide into the solution of calcium polysulphide formed until the former is decolorized. Carefully crystallize at a low heat, when 6-sided efflorescent crystals will form. A syrup may be prepared from 1 part of crystallized calcium hyposulphite, 2 parts of distilled water, and 17 parts of syrup of orange. Dose of syrup, 1 to 4 fluid drachms; of the salt, from 5 to 20 grains.

CALCII SALICYLAS ($Ca[C_7H_5O_3]_2.2H_2O$).—Prepared by neutralizing a hot aqueous solution of salicylic acid with calcium carbonate, and filtering, or by decomposing sodium salicylate in solution with calcium acetate. It is a gritty, crystalline, white powder, feebly soluble in cold water (1 in 2000), and without taste or odor. Diluted acetic, sulphuric, hydrochloric, and nitric acids dissolve it. In doses of 5 to 25 grains it has been employed in the *diarrhœal disorders of children.* It is not, however, very highly valued.

CALCIUM DITHIO-CARBONATE ($CaCOS_2$), *Dithio-carbonate of lime.*—An hygroscopic, orange-red, crystalline powder, sparingly soluble in water and in alcohol. In aqueous solution, if exposed to the air, it decomposes, sulphur and hydrogen sulphide being among the products. Pyogenic bacteria are said to be inhibited, but not destroyed, by a 1 per cent solution (Sabbatini). Upon the human skin, irritation, burning, and pustulation may result from the application of a 20 per cent solution. Locally, it has been applied to stubborn *skin affections*, such as *purulent venereal ulcers, eczema, lupus, psoriasis,* and other cutaneous disorders.

CROCUS (U. S. P.)—SAFFRON.

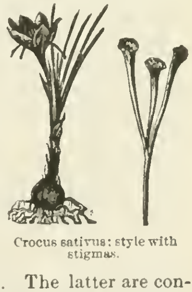
"The stigmas of *Crocus sativus*, Linné"—(*U. S. P.*).

Nat. Ord.—Irideæ.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 274.

Botanical Source.—Saffron is a perennial herb, with a roundish cormus; the integuments consisting of parallel fibers, distinct at the upper end. The leaves are radical, very narrow, linear, long, flaccid, revolute at the margin, with a longitudinal, white furrow above, and surrounded at the base with long membranous sheaths. The flowers are large, axillary, nearly or quite sessile on the bulb, with a 2-valved membranous, thin, transparent, radical spathe, appearing with the leaves, striate, with a long white tube, and purple, elliptical segments. The style is filiform, with 3 stigmas deeply divided, linear wedge-shaped, and of a deep-orange color, hanging down on one side of the flower, fragrant, and notched at the points. The capsule is 3-celled, and many-seeded; the seeds roundish (L.—W.).

Fig. 89.



Crocus sativus: style with stigmas.

History.—Saffron is indigenous to Asia Minor, and is much cultivated in some parts of Europe. The greater portion in this country is shipped from Spain and France. The former country sends *Spanish Alicante*, or *Valencia saffron*, which is admixed, to some extent, with other varieties. The latter are considered objectionable by the *U. S. P.* France sends *Gâtinais*, or *French saffron* which is a better grade than the Spanish. English and Austrian saffron are both of very fine quality, but do not reach our markets. Saffron is also cultivated in the United States, notably in Pennsylvania. The Pennsylvanian product, which is of first quality, is often termed *American saffron*, a term which should not be confounded with that of the florets of another plant—the *Carthamus tinctorius*—which is the true *American saffron*. The so-called *African saffron* is usually *Carthamus* florets, though the flowers of a south African plant (*Lyperia crocea*, Ecklon), of the natural order *Scrophulariaceæ*, have passed under that name. Saffron requires a rich soil, and the yield per acre is said to be about 35 pounds. Saffron blossoms in autumn, the flowers are in abundance, and mantle the fields with a flax-gray covering. Each flower has one style, on the summit of which are the smooth, shining, dark, orange-red stigmas. The flowers are gathered early in the morning, just before they open; the stigmas are picked out, very carefully dried by the heat of a stove, and sometimes compressed into firm cakes. Five pounds of fresh saffron are required to yield one pound of dry (*Ed.*). The other parts of the flower are useless; of the stigmas it takes 70,000 to make one pound of saffron (P. L. Simmonds, *Amer. Jour. Pharm.*, 1891, p. 200). Saffron of commerce was formerly of two kinds, viz.: The *Hay saffron*, which is the best, and at present alone in use, consisting simply of the stigmata entangled together, and retaining their original deep-orange color; and the *Cake saffron*, which is in flexible cakes, about half a line in thickness, and of a dirty, brownish, orange tint, made by beating the stigmata together before they are quite dry.

Description.—The *U. S. P.* thus describes saffron: "Separate stigmas, or three, attached to the top of the style, about 3 Cm. (1⅕ inch) long, flattish-tubular; almost thread-like, broader and notched above; orange-brown; odor strong, peculiar, aromatic; taste bitterish and aromatic"—(*U. S. P.*). Saffron imparts its properties to water, vinegar, or spirit. The best saffron is that which is recent, being very slightly damp, not readily reduced to powder, of a strong, acrid, diffusive odor, but free from any disagreeable smell when burned; it imparts a soapy-like touch between the fingers, coloring them orange. On account of the great volatility of the aromatic part of the saffron, it should be wrapped in bladder, and preserved in a box, or tin case (*Ed.*).

Chemical Composition.—The yellow aqueous-alcoholic extractive matter obtained in the early analyses of saffron by Vogel, Bouillon-Lagrange (1811), and Aschoff (1818), was called *polychroit*, on account of its property of changing color when acted upon by certain reagents. It was first obtained pure by Quadrat, in 1851, and named *crocin* by Rochleder and Mayer, in 1862, who found it identical with the yellow coloring matter of *Gardenia grandiflora*, Loureiro, and established its glucosidal nature. When heated with acids, it splits into sugar and *crocetin* which Weiss (1868) proposed to call crocin, and retain the older name (polychroit) for the mother-substance.

R. Kayser (*Amer. Jour. Pharm.*, 1885) obtained *crocin* by first depriving saffron of its fatty matter by means of ether, extracting the coloring matter with cold water, and removing it from its aqueous solution by shaking with bone-charcoal, washing with cold water, evaporating to dryness, and extracting the coloring matter with 90 per cent alcohol, which upon evaporation left *crocin* as a brittle residue. It is soluble in water and dilute alcohol, less soluble in absolute alcohol, almost insoluble in ether. Its formula is $C_{44}H_{70}O_{28}$. In strong sulphuric acid it dissolves with blue color, which first turns to violet, then cherry-red, and subsequently to brown. Heated with weak bases (*e. g.*, baryta water), it is converted into *crocetin* ($C_{34}H_{46}O_9$), insoluble in pure water, soluble in alcohol and alkaline liquids, and a peculiar sugar not quite identical with dextrose, hence called *crocose*.

Picro-crocin, or *Saffron-bitter* ($C_{38}H_{66}O_{17}$), Kayser observed to crystallize from ethereal extracts of saffron in colorless prismatic needles, melting at 75° C. (167° F.), and having a bitter, persistent taste. Soluble in water and alcohol, sparingly soluble in ether. It is a glucosid which, when acted upon by weak bases, resolves into *crocose* and a volatile oil (terpene, $C_{10}H_{16}$), which has the characteristic and intense odor of saffron. The same oil was prepared by R. Kayser by distilling saffron with steam in a current of carbonic acid gas.

Adulterations and Tests.—Muscular fibers are said to have been used as an adulterant. They may be known by the odor of burning flesh, emitted on burning the suspected article. Rubbing between the finger and thumb, without staining the skin yellow, indicates that the saffron has been exhausted by water or spirit. According to J. Muller, genuine saffron immediately assumes an indigo-blue color, when acted upon by chemically pure sulphuric acid, while the adulterations remain unchanged (*Chem. Gaz.*, May 1845, p. 197).

Saffron has ever been liable to various forms of adulteration, and the practice does not seem to have abated. It is frequently substituted in part, or entirely replaced by the florets of *Carthamus tinctorius;* yet substitution in this case may rather be due to ignorance, owing to the misleading name *American saffron*, affixed to this plant. Other substitutes are the worthless yellow styles of its flowers, or the florets of Calendula officinalis, the flowers of Arnica montana, the petals of red poppy, especially cut into shape for this purpose (C. Bernbeck, 1882), etc. Saffron is sometimes weighted by the addition of oil, or glycerin, or water, the gain from the latter source often being attained by storing the drug in damp places. Thus Dr. Niederstadt, in 1887, observed in "good" Spanish saffron 20 per cent of moisture, while genuine saffron contains from 10 to 12 per cent (Cæsar and Loretz, 1891). Sand and other mineral matters, as calcium sulphate, barium sulphate, or soluble salts, as sodium sulphate (Beringer, *Amer. Jour. Pharm.*, 1889) have been used as adulterants of saffron, and are admixed by means of honey or syrup. These additions (if they do not consist of ammonium salts) naturally increase the amount of ash, which should be about 5 per cent in good saffron. Adulteration of saffron with barium sulphate has been detected by Morpurgo (*Drug. Circ.*, 1897, p. 129), microscopical examination having revealed abnormal crystals within the cells. Closer examination showed that the drug had been soaked in solution of a barium salt and then treated with solution of a soluble sulphate. In a similar sophistication with barium sulphate, the ash amounted to 60 per cent (*Vierteljahreschrift* von Hilger, etc., 1896). The addition of sugar, according to Dr. Niederstadt, is difficult to detect, since sugar is a natural constituent of saffron, amounting to 15 per cent. Another adulteration often reported, is the admixture of a large proportion of shredded fibers of sedge grass, tinged with safranin (a coal-tar color), or with some nitrophenol compound (related to picric acid). Saffron may also be exhausted of its color and then dyed with yellow aniline or other yellow.

The *U. S. P.* provides the following tests for saffron: Saffron should not include the yellow styles. When pressed between filtering paper, it should not leave an oily stain. When chewed it tinges the saliva deep orange-yellow. When soaked in water, it should not deposit any pulverulent, mineral matter, nor show the presence of organic substances differing in shape from that described. On agitating 1 part of saffron with 100,000 parts of water, the liquid will acquire a distinct yellow color. No color is imparted to benzin agitated with saffron (absence of picric acid and some other coal-tar colors). On drying saffron at 100° C. (212° F.), it should not lose more than 14 per cent of its weight (absence of added water). When thus dried, and ignited with the free access of air, 100 parts of the dry saffron should not leave more than 7.5 per cent of ash (absence of foreign inorganic substances).

Action, Medical Uses, and Dosage.—Emmenagogue and diaphoretic. It has been reputed of benefit in *amenorrhœa*, *dysmenorrhœa*, *chlorosis*, *hysteria*, and in *suppression of the lochial discharge.* It arrests chronic discharges of blood from the uterus. In *menorrhagia*, with dark clotted losses, give 5 drops of specific crocus, or a teaspoonful of the infusion several times a day. Saffron is not the important drug it was at one time. Like many of the old remedial agents, it is being supplanted by others that serve better the purpose. As a diaphoretic, it is used in *febrile* and *exanthematous diseases*, especially of children. In the latter it assists in producing the eruption, and is valuable in cases of retrocession of the same. Many consider this valuable agent as inert. Dose of the powder, from 12 to 40 grains; of the tincture or syrup, from 1 to 2 fluid drachms; of the infusion (saffron, ʒj; hot water, Oj.), from 1 to 3 fluid ounces. Saffron is recommended for coloring tinctures, etc., but it is too costly an article for this purpose.

Related Species.—*Gardenia grandiflora*, Loureiro; *Gardenia radicans*, Thunberg; *Gardenia florida*, Linné. *Nat. Ord.*—Rubiaceæ. Europe and south Asia. The berries of these shrubs are used as a refrigerant and demulcent. The fruit pulp contains a coloring material identical with *polychroit*, and has been used in the Orient to impart a yellow color to fabrics.

CUBEBA (U. S. P.)—CUBEB.

"The unripe fruit of *Piper Cubeba*, Linné filius" (*U. S. P.*) (*Cubeba officinalis*, Miquel).

Nat. Ord.—Piperaceæ.

Common Name: *Cubebs.*

Illustration: Bentley and Trimen, *Med. Plants*, 243.

Botanical Source.—This is a perennial plant, with a climbing stem, whose branches are round, of the thickness of a goosequill, ash-colored, smooth, and rooting at the joints; and when very young are minutely downy, as well as the petioles. The leaves are 4 to $6\frac{1}{2}$ inches long by $1\frac{1}{2}$ or 2 inches broad, petioled, oblong, or ovate-oblong, acuminate, rounded, or obliquely cordate at base, strongly veined, netted, coriaceous, and very smooth. The flowers are diœcious, and arranged in spikes at the end of the branches opposite the leaves, on peduncles the length of the petioles. The fruit is rather longer than that of black pepper, globose, and borne on pedicels from $\frac{1}{3}$ to $\frac{1}{2}$ inch long (L.).

History and Description.—Piper Cubeba inhabits Java and Prince of Wales Island, Sumatra, Southern Borneo, and other isles in the Indian ocean, growing without cultivation in the forests. They are also cultivated to some extent in the coffee plantations of Java, being easy to grow when placed so as to climb the shade trees which are necessary in a coffee plantation. The fruit is gathered before it is fully ripe, and when dried is the part used in medicine. The fruit or berries are nearly globular, rough, grayish, somewhat lighter-colored than black pepper, of a rather pleasant, aromatic odor, and a hot, bitter, and somewhat camphoraceous taste. The cortical portion appears to have been thinner and less succulent than in black pepper, and contains within it a hard, spherical seed, which is whitish and oily. Cubebs are officially described as follows: "Globular, about 4 or 5 Mm. ($\frac{1}{6}$ to $\frac{1}{5}$ inch) in diameter, contracted at the base into a rounded stipe about 6 or 8 Mm. ($\frac{1}{4}$ to $\frac{1}{3}$ inch) long, reticulately wrinkled, blackish-gray, internally whitish and hollow; odor strong, spicy; taste aromatic and pungent. Cubeb should not be mixed with the nearly inodorous rachis or stalks"—(*U. S. P.*). The volatile oil is much used in medicine. The powder of cubeb becomes inert after a time, in consequence of the loss of its volatile oil; hence, it is better to powder the drug only as required for use.

Chemical Composition.—The more important constituents of cubebs are: Volatile oil (see *Oleum Cubebæ*), fatty oil, *cubebin*, *cubebic acid*, and indifferent *cubeb-resin*, the latter two substances alone carrying the diuretic qualities of the drug. Calcium and magnesium malates are also present. Cubebin, cubebic acid, and cubeb resin may be obtained in one operation according to explicit directions given by E. A. Schmidt in *Archiv. der Pharm.*, 1870, pp. 1–49. *Cubebin* ($C_{10}H_{10}O_3$ according to Weidel, 1877), first obtained pure by Soubeiran and Capitaine, in 1839, is present in about 2.5 per cent (Schmidt). It is an indifferent, crystallizable substance without taste or odor, but is bitter in alcoholic solution. It melts at 125° C. (257° F.), is insoluble in cold, and but little soluble in hot water; requires 76 parts of absolute alcohol for solution, and is much less soluble in weak alcohol. It is also soluble in about 27 parts of ether, likewise in benzene, acetic acid, and chloroform, the solution in the latter solvent being lævo-rotatory. Cubebin is soluble in concentrated sulphuric acid with blood-red color (Husemann and Hilger, 1882). Weidel (1877) found that when fused with caustic potash, cubebin yields carbonic acid, acetic acid, and *protocatechuic acid* ($C_6H_3.[OH]_2.COOH$). This fact, in connection with the observation of Pomeranz (1887), to the effect that cubebin yields, upon oxidation *piperonylic acid* ($C_6H_3:[O.O.CH_2]COOH$), establish it to be a derivative of *pyrocatechin* (ortho-dioxybenzene) ($C_6H_4[OH]_2$). *Cubebic acid* ($C_{13}H_{14}O_7$, Schmidt; $C_{28}H_{30}O_7.H_2O$, Schultze, 1873), was obtained by Schmidt in the quantity of about 1.7 per cent. When pure it forms a white, resinous mass, insoluble in water, soluble in alcohol, ether, chloroform, stronger water of ammonia, and caustic alkali. It forms salts with alkalies and the bases of heavier metals, the former being soluble in water. The sodium salt was obtained in crystals by Schultze. Concentrated sulphuric acid dissolves cubebic acid with crimson color, a reaction pointed out by E. M. Holmes (1885), as useful in the detection of adulteration by "false cubebs" (see *Related Species*). *Cubeb resin* ($C_{13}H_{14}O_3$) is an indifferent substance, soluble in alcohol and alkalies, sparingly soluble in chloroform, ether, and carbon disulphide. The yield is from 2 to 3 per cent. F. V. Heydenreich (1868) instituted a series of experiments to determine whether the active principle of cubebs resided in its oil, its oleoresin, or in the cubebin. He concluded that the diuretic property of cubebs resides in its soft resin (now known as being composed of *cubebic acid* and *cubeb resin*); that cubebin is comparatively inert; and that the volatile oil is carminative and stimulant, producing in large doses the irritation common to analogous oils. These results were confirmatory of those previously announced by Bernatzik (1863).

Action, Medical Uses, and Dosage.—Cubebs are mildly stimulant, expectorant, stomachic, and carminative. They act more particularly upon mucous tissues, arresting excessive discharges, especially from the urethra. In large doses they produce increased frequency and fullness of pulse and augmented heat; occasionally they cause nausea, vomiting, burning pain, griping, or even purging. Sometimes they cause a rash-like eruption on the skin. They exercise an influence over the urinary apparatus, frequently producing diuresis, rendering the urine of a deeper color, with a peculiar, aromatic odor. They have been successfully employed in *gonorrhœa*, *gleet*, *leucorrhœa*, *catarrh of the urinary bladder*, *chronic inflammation of the bladder*, *abscess of the prostate*, *chronic laryngitis* and *bronchitis*, *dyspepsia* due to an atonic condition of the stomach, etc. Generally, it is better to use them after the high inflammatory symptoms have subsided. If they do not afford benefit very soon, they should be used no longer. There has been much controversy as to whether this drug should be employed during the active stage of gonorrhœa, or after the active symptoms have subsided. Prof. Locke, whose experience has been large, declares in favor of it after the active inflammatory stage has passed, and that it should be employed only after the profuse discharge has ceased. He believes it contraindicated in all inflammatory states, and prefers it in the *chronic form of gonorrhœa*, believing it more successful than in the acute. In chronic gonorrhœa, 30 grains of the powdered berries are to be given 3 times a day to produce an aggravated condition of the disease—a substitutive inflammation—and as this passes off the disease is decidedly better. This method should be persisted in until urination is painful, and then the dose should be lessened from day to day until a cure is effected. Christison states that he has known the use of cubebs to be frequently attended, like copaiba, with an ephemeral synocha, followed by a prompt cessation of the gonorrhœal discharge; in which disease they may be given in powder, along with water or milk, or made into a paste with copaiba. The following preparations have been successfully used in *gonorrhœa* and *gleet*: 1. Take of ethereal extract of cubebs, solidified balsam of copaiba, and carbonate of iron, of each 2 drachms; resin of podophyllum, 10 grains. Mix, and divide into pills of 4 grains each, of which 1 or 2 may be given 3 times a day. 2. Take of pulverized cubebs, podophyllum, white pond lily, of each ½ ounce; Holland gin, 1 pint; macerate for several days, and give sufficient doses 3 times a day to act slightly on the bowels. 3. Take of solidified capaiba 2 ounces, ethereal extract of cubebs 1 ounce, oil of juniper a sufficient quantity; mix and divide into pills of 4 grains each, of which 1 or 2 may be taken 3 times a day. Not only does cubeba affect the urinary tract, but it acts upon all the mucous tissues of the body, restraining profluvia, giving tone, besides augmenting the appetite and improving digestion. While contraindicated in acute inflammations it is often of service in *chronic inflammations*. When in *leucorrhœa* the discharge is copious and offensive, give large doses (30 to 40 grains 3 times a day), until a decided effect is made; then diminish the dose from day to day. *Chronic inflammatory states of the female bladder* and *urethra*, with constant urging and painful efforts to urinate, are relieved by 5-drop doses of specific cubeba given every 3 or 4 hours. *Spermatorrhœa*, *cystic catarrh*, *nocturnal urinal incontinence* of children, and *prostatic abscess*, are all benefited when the conditions are first aggravated by the larger dose, and the drug lessened as the treatment progresses. The urethral burning is the indication for it. The greater the debility the more pronounced are its effects. Use it for the scalding sensations often experienced by women in urinating, a condition common to the menstrual period, and for irritation and burning of the vulva. Prof. Scudder suggests the small dose "in debility with irritation of the reproductive apparatus; prostatorrhœa, uneasiness and formication of the scrotum and anus, and diseases associated with reproductive weakness."

Atonic respiratory troubles with profuse expectoration, are benefited by 5 to 10 drop doses of specific cubeba on sugar every hour. It has been given in this manner and the berries smoked for the relief of *nasal catarrh*. The latter procedure is often beneficial in *hay fever*. Equal parts of black German snuff and powdered cubebs are stimulating and alterative in excessive catarrhal states of the nasal membranes; snuff into the nostrils several times a day (Locke). M. Trideau found a syrup of cubebs, in connection with one of copaiba, to be almost a specific in *croup*. M. Berjeron has also met with great success in the same disease, but he prefers to administer the oleoresin of cubebs either in capsules or in emulsion, having the children take according to their ages from 15 to 60 grains per day. *Chronic sore throat* with great relaxation of the membranes and excessive secretion is benefited by specific cubeba suspended in syrup. Dose of cubebs in powder, from 5 grains to 1 drachm 3 times a day; of the tincture, ½ to 2 fluid drachms; of the oil, from 5 to 30 drops; of specific cubeba, 1 to 60 drops.

Specific Indications and Uses.—Latter stage of gonorrhœa, after profuse discharges have ceased; chronic gonorrhœa; enfeebled states of the large intestine and rectum; subacute inflammations of the urinary passages; urethral burning; scalding of urine in females; irritation and burning of vulva; debility with profuse discharges from the mucous tissues.

Related Species and Products.—*Piper Clusii*, Cas. De Candolle (*Cubeba Clusii*, Miquel; *Piper Afzelii*, Lindley). This plant, from French Africa, furnishes a drug supposed to be more closely allied to black pepper than to cubebs; it almost always has a long stalk attached, and its size is about one-half less than that of the commercial drug. The color is ashen-gray, and the taste hot. It is known as *African pepper*, *African cubebs*, *West African black pepper*, *Ashantee pepper*, and *Guinea pepper*. The plant with its ripened cluster of red fruit is regarded as one of the handsomest and most conspicuous specimens of African vegetation. Stanislas Martin found the chemical composition of African pepper to be nearly the same as the Sumatra or Malabar cubebs, and believes it to possess the same properties as these, provided it be perfectly cleansed of its stalks. Stenhouse, however, in 1855, states that its proximate constituent is *piperine*, and not cubebin, thus bringing it closer to pepper than to cubebs. These berries are used as a condiment in tropical West Africa.

OTHER SPECIES.—The following plants also yield berries that more or less resemble cubebs, and some of which have been used as substitutions therefor. They are called "false cubebs." *Cubeba Lowong*, Miquel (*Piper Lowong*, Blume); *Cubeba canina*, Miquel (*Piper caninum*, Dietrich); *Cubeba Wallichii*, Miquel (*Piper ribesioides*, Wallich); *Cubeba crassipes*, Miquel (*Piper crassipes*, Korthals), probably the *Piper anisatum* of Humboldt and Bonpland; and *Laurus Cubeba* Loureiro (see *Pharmacographia*). Mr. Holmes recommends as a useful test the bright, indigo-blue coloration that the genuine drug yields with solution of iodine, both in the form of powder and decoction (undoubtedly due to the action of iodine upon the essential oil of cubebs. and not to the presence of starch, as has been suggested), and the crimson color the drug imparts to strong sulphuric acid (see paper on this subject by E. M. Holmes, in *Pharm. Jour. Trans.*, Aug., 1892, or *Amer. Jour. Pharm.*, 1892, p. 494).

CUMINUM.—CUMIN.

The fruit of *Cuminum Cyminum*, Linné.

Nat. Ord.—Umbelliferæ.

COMMON NAME: *Cumin.*

Botanical Source.—This is an annual herb, with an erect, round, slender, branched stem, about a foot high. The leaves are multifid, with long, filiform segments. The flowers, small, white, or pink, are overtopped by the bracts, which, after flowering, are reflexed. The umbels, both partial and general, consist of about 5 rays, with the involucres consisting of 2 or 3 filiform, 1-sided bracts. The fruit is about 2 lines in length, much longer than the pedicels, nearly tapering, but little contracted at the sides, fusiform, crowned by the short teeth of the calyx, densely covered with short rough hair upon the channels, and less densely upon the ridges, which are paler, filiform, and a little raised; the seeds or half-fruits, 2 in number, are oblong, plano-convex, with the plane surfaces together (L.).

History and Description.—This plant is cultivated in many parts of Europe though originally from Egypt. It is referred to in Scripture (Isaiah xxviii, 25–27, and Matt. xxiii, 23), and was a lesser titheable product in Palestine (*Pharmacographia*). The fruit or seeds are ovate or fusiform, of a light-brown or grayish color, with 2 adhering concavo-convex fruits. The fruit resembles caraway, but is larger. Each seed or fruit presents 5 filiform, rough, primary ridges, between which are 4 secondary ones, which are furnished with small prickles. Between each primary ridge is an elongated oil tube (vitta) besides 2 vittæ on the face of the mericarp. Insects often destroy the fruit. Their odor and taste is similar to that of caraway, but warmer, and not so agreeable.

Chemical Composition.—Bley (1829) found the fruit to contain resin, fatty matter, gum, lignin, protein bodies, salts, largely composed of malates, extractive, and volatile oil. The volatile oil, which is the chief constituent, may be separated by distillation with water, and is of a yellowish color, thin, having a specific gravity varying from 0.890 and 0.930 at 15° C. (59° F.) (Schimmel & Co.), and possessing the taste and odor of the plant. This oil is a compound, consisting mainly of 2 oils, viz.: Cymol (*cymene*, or para-methyl-propyl-benzene, $C_{10}H_{14}$), a hydrocarbon having the odor of lemons; cuminol (cumin-aldehyd) ($C_6H_4[C_3H_7]CHO$), an oxygenated substance possessing the odor of caraway. Lastly, a terpene, having the composition $C_{10}H_{16}$, was believed to have been obtained, in 1896, by Wolpian (see Schimmel's *Report*, Oct., 1896). When treated with nitric acid, cumin-aldehyd is oxidized to crystallizable *cuminic acid* ($C_{10}H_{12}O_2$). Trapp (1858) obtained from the seeds of *Cicuta virosa*, Linné, essential oils identical with those of cumin oil. The yield of oil of cumin from raw material, according to Schimmel & Co. (*Semi-annual Report*, Oct., 1893), is as follows: From Syrian fruit, 3 to 4 per cent; Maltese fruit, 3.5 per cent; Moroccan fruit, 3 per cent; East Indian, 3 to 3.5 per cent. Cymol has a density of 0.860 at 15° C. (59° F.), and boiling point near 174° C. (345.2° F.). Cuminol has a density of 0.972 at 15° C. (59° F.), and boiling point near 229° C. (444.2° F.). Schimmel & Co. report in October, 1896, that the demand for cumin oil has been constantly decreasing and is now inconsiderable.

Action, Medical Uses, and Dosage.—Highly stimulant and carminative, possessing medical properties similar to the other aromatic fruits of umbelliferous plants, but more stimulating. They are seldom used in the United States. Dose, from 15 to 60 grains.

Related Drugs.—NIGELLA. *Fennel flower.* The seeds of two ranunculaceous plants, the *Nigella sativa*, Linné, *Nutmeg flower*, or *Small fennel flower*; and *Nigella damascena*, Linné, or *Ragged Lady*. They are natives of Syria and south Europe, and are cultivated in gardens. The leaves of these plants resemble those of fennel. The seeds of the first species are rough, triangular, ovate, two surfaces being flat and the other convex, about $\frac{1}{12}$ to $\frac{1}{10}$ inch long, externally dull-black, and internally white and oleaginous. To the taste they are acrid, somewhat spicy, and pungent. In odor they are aromatic or camphoraceous, reminding some persons of nutmegs, others of cajuput. The seeds of *ragged lady* are occasionally sold under the name *magnolia seeds*. They have rounded angles, and a deeply-netted and corrugated testa. When rubbed they exhale an odor comparable with that of strawberries. The seeds of *nutmeg flower*, according to Husemann and Hilger, contain 1.5 per cent of an essential, colorless and fluorescent oil, and consists of a substance $C_{20}H_{24}O$ and a terpene (Flückiger). Its odor differs from that of the seeds, and a fixed oil to the extent of 35 per cent, was obtained by Reinsch, in 1841. Flückiger has shown it to be composed of myristin, stearin, and palmitin. A yellow extract-like mass, having a bitter taste, was isolated by Reinsch and named *nigellin*. It is not, however, regarded as a distinct body.

Melanthin ($C_{20}H_{33}O_7$), a glucosid, was isolated by H. G. Greenish, in 1880. It is amorphous, acrid, foams when shaken with water, is very soluble in alcohol, but scarcely soluble in water, benzin, benzol, ether, and carbon disulphide. Acids split it into glucose and *melanthigenin* ($C_{14}H_{23}O_2$). Both principles impart a rose-red tint with pure sulphuric acid in about 15 minutes. The color changes to violet-red upon long standing. The seeds of Nigella damascena were observed by Greenish to yield to petroleum benzin a fluorescent principle, but contain no melanthin (*Amer. Jour. Pharm.*, 1882, pp. 10 and 304), and A. Schneider (1890) showed that this was due to a crystalline alkaloid which he named *damascenine*, the compounds of which, however, are non-fluorescent.

CUNILA.—DITTANY.

The whole herb of *Cunila mariani*, Linné.

Nat. Ord.—Labiatæ.

COMMON NAMES: *American dittany, Mountain dittany, Stonemint.*

Botanical Source.—This is an indigenous, perennial plant, with a fibrous root, and smooth, slender, 4-angled, mostly purplish, corymbosely branched stems, growing 1 or 2 feet high. The leaves are opposite, small, nearly smooth, ovate, serrate, subsessile, roundish or subcordate at the base, tapering to a point, and punctate with pellucid dots. The flowers are white or pale-red, pedunculated, with subulate bracts at the base of the 3-forked pedicels, in corymbose, axillary, and terminal cymes. The corolla is nearly twice as long as the calyx, pubescent, middle lobe longer than the others, upper lip erect, flat, emarginate, and lower lip spreading. The calyx is green, 10-ribbed, equally 5-toothed, hairy in the throat, and punctate. Stamens 2, erect, exserted, distant. Anthers small, didymous; stigma bifid, exserted; seeds 4, small, obovate (W.—G.).

History and Chemical Composition.—Dittany is found growing in dry hills and woods, and on rocks, in nearly all parts of the United States, flowering from June to October. The herb is very fragrant, with a warm, spicy taste; its taste and odor are due to a volatile oil which may be procured by distillation. Mr. P. Milleman found the herb to contain a warm, pungent, delicately fragrant, volatile oil, tannic acid, a trace of glucose, gummy matter, considerable extractive matter, a part of which was bitter and acid, and dark-green resin; the ashes gave salts of potassium, calcium, magnesium, and iron (*Amer. Jour. Pharm.*, 1866, p. 495).

Action, Medical Uses, and Dosage.—Stimulant, carminative, antispasmodic, and diaphoretic. Used freely in warm infusion to promote perspiration, to relieve *flatulency*, and as an emmenagogue. Popularly employed for *colds*, *headaches*, and *fevers;* also to relieve *nervous headache*, and *hysterical disorders*, *colic*, *indigestion*, and many *nervous affections*. The volatile oil possesses all the medicinal properties of the herb, and may be given in doses of from 5 to 10 drops.

Related Species.—*Dictamnus albus, Bastard dittany, White fraxinella.* A bitter, aromatic root-bark used by Baron Störck for *worms*, *epilepsy*, *hysteria*, *amenorrhœa*, and *intermittent fevers*. Dose, 20 to 60 grains.

CUPRI ACETAS.—COPPER ACETATE.

FORMULA: $Cu(C_2H_3O_2)_2+H_2O$. MOLECULAR WEIGHT: 198.86.

SYNONYMS: *Crystallized ærugo*, *Crystallized verdigris*, *Copper verditer*, *Flora virides aëris*, *Cupric acetate*, *Acetas cupricus*, *Cuprum aceticum*, *Æruga crystallisata*, *Æruga destillata*.

Preparation.—Acetate of copper is prepared by dissolving subacetate of copper (verdigris), in an excess of acetic acid, adding a small portion of water, filtering, and crystallizing the filtrate by evaporation It may also be prepared by the double decomposition of lead (or calcium) acetate and copper sulphate. It was known to the Arabs, who obtained it by dissolving verdigris in warm vinegar, decanting the supernatant fluid, evaporating in copper receptacles, and finally crystallizing the salt in wooden vessels.

Description.—The neutral acetate of copper, or crystallized ærugo, also called *Crystals of Venus* ($Cu[C_2H_3O_2]_2+H_2O$), is little used in medicine as such, but is employed in the form of an alcoholic solution known as *Rademacher's Tincture of Acetate of Copper*. It forms small, dark-green, rhombic prisms, inclining to a bluish hue, of a feeble, acetous odor, a nauseous, metallic taste, efflorescent, soluble in 5 parts of boiling water (15 of cold), partially soluble in alcohol (14 parts of hot and 135 of cold), inflammable, burning in the open air with a beautiful green flame. Its solution in water is bluish-green, and when boiled evolves acetic acid and precipitates a basic salt colored dark-blue by ammonia water (or ammonium carbonate) in excess. Stronger mineral acids liberate acetic acid from it.

TINCTURA CUPRI ACETI RADEMACHERI.—*Rademacher's Tincture of Acetate of Copper.* Take crystallized copper acetate 1 part, warm water 10 parts; solve. Add to the solution alcohol 8 parts. "The original process of Rademacher was by the double decomposition of crystallized sulphate of copper and crystallized acetate of lead, and we prefer it at the present day. It is as follows: Take of crystallized sulphate of copper and of crystallized acetate of lead, each 3 troy ounces; water, 17 fluid ounces; alcohol, 13 fluid ounces. Powder the salts separately, and then rub them together in a mortar until they assume a pasty condition. Then gradually add the water, and afterward the alcohol. Place the mixture in a bottle, and after 14 days, carefully decant the clear dark-green or blue solution from the precipitate of lead sulphate, and filter it through paper" (Lloyd's *Chemistry of Medicines*, p. 262).

Action, Medical Uses, and Dosage.—I. CUPRUM, or *Copper*. Metallic copper seems to have but little influence upon the human system. Copper workers, who are constantly exposed to its dust, are not poisoned by it, though they are usually somewhat anemic and experience sensations of lassitude, vertigo, and gastric disturbances. Their gums present a greenish or olive-colored line, and their teeth, which also present the same discolorations, are often lost at an early day. They seem to be peculiarly free from choleraic and typhoid diseases. Those who work in copper leaf (bronze powder) are said to become subject to either diarrhœa or constipation, with abdominal tenderness and colic, nausea, vomiting, and have a retracted gum with a purplish line or edge, and a peculiar anemic appearance, emaciation, cough, and lack of muscular power. More recent experiments have demonstrated the fact that copper is at least not a cumulative poison, *e. g.*, as lead, and the so-called "*colique de cuivre*," asserted in the eighteenth century to be a definite disease, does not exist (*Amer. Jour. Pharm.*, 1884, p. 293). The soluble copper salts, however, produce a coppery taste, nausea, vomiting, severe colic, frequent bloody or black stools, quick, small, irregular, and sharp pulse, burning and thirst, syncope, dyspnœa, suppression of urine, or scanty urine, burning when being voided, intense headache, cramps and spasms, and finally death. This extreme action, however, is rare.

II. *Cupric acetate* in the form of Rademacher's tincture is quite extensively employed in our school as a blood maker. Prof. Scudder preferred *greened pickles* to any other form of administration, and he points out the cases requiring *cuprum* (as the greened pickles and tincture of the acetate are known in Eclectic therapy), as those of *anemia* without great loss of flesh, the surface " pallid, yellowish, greenish, or sometimes tawny, skin waxy, parts usually colored with blood, pale, with sometimes a greenish tinge." Tongue pale, broad, usually clean, bowels inactive, "pulse rather full, but without sharpness of stroke." He employed it in any condition of disease presenting these indications. *Leucocythemia*, *chlorosis*, and *anemia* yielded to it when other remedies failed. The soft, full, and doughy tissues gave way to firmer flesh, and the appetite and blood making were improved. It has been suggested (6 x trit.) in *explosive cough*, meeting conditions similar to those calling for drosera. It is particularly recommended in *whooping-cough* with a tendency to convulsions. Its use in *paralysis* depending upon *sclerosis of the spinal cord* has been advised, as it has also in the later stages of *cerebro-spinal meningitis* where structural alteration is threatened. The general indications should guide to its selection. It should be remembered as a blood maker after severe *hemorrhages* or other *exhausting discharges*. Faulty nutrition in *diseases of the ear*, especially when dependent upon chlorosis, and with tinnitus as a prominent symptom, are admirably met with cuprum, $\frac{1}{5}$ to $\frac{1}{3}$ drop 4 times a day. Impaired hearing is usually present. Dose: Add of the tincture of the acetate or of specific cuprum, gtt. x to xx to aqua ℥iv, and give a teaspoonful 4 times a day. Of the 6 x trituration 1 to 3 grains 3 or 4 times a day. The sulphate of copper in doses of $\frac{1}{20}$ to $\frac{1}{2}$ grain fulfil practically the same indications.

Specific Indications and Uses.—Skin tawny, dirty, yellowish, greenish, pallid, or waxy; parts usually red are pale or greenish; tongue broad, uncoated, and pale; gums blanched; pulse small, soft, and quicker than usual; bowels torpid with colorless discharges, and if loose, the pale evacuations resemble rice-water. Anemic states with dirty-greenish tinge, and without great loss of flesh; chlorosis; tissues full, but soft and doughy; after hemorrhages or exhaustive discharges as a bloodmaker, when the skin is pale and transparent.

Related Bodies.—CUPRUM. *Copper*. Symbol: Cu. Atomic weight: 63.18. This metal appears to have been known even before the time of Moses. It exists native in different parts of the globe, especially near Lake Superior, Michigan, and Chili, and is found in a great variety of compounds, principally in the form of *copper pyrites* (double sulphide of copper and iron ($CuFeS_2$, or $Cu_2S+Fe_2S_3$). *Copper glance* (cuprous sulphide), another copper mineral, has the composition Cu_2S. It is also found as *malachite*, a most beautiful velvety-green mineral, which is a combined copper carbonate and hydroxide ($CuCO_3+Cu[OH]_2$). Both oxides of copper (CuO and Cu_2O) are occasionally found native. Copper is obtained from its ores by various metallurgical processes. In recent years the manufacture of copper by electrolytic decomposition of solutions of copper salts has been gaining ground. In the old

English process of *copper smelting*, the sulphur-bearing copper ores undergo several processes of roasting, iron slags being added at the proper stages, until nearly all the copper is converted into *white metal*, which is almost pure cuprous sulphide (Cu_2S). This is again roasted, resulting in the partial formation of CuO; the mixture, upon fusion in properly constructed furnaces, next yields metallic copper and sulphurous acid, as follows: $2CuO+Cu_2S=4Cu+SO_2$. The copper thus obtained (*blister copper*) is at last refined. Pure copper is a reddish, brilliant, ductile, sonorous, and malleable metal, of a nauseous, styptic taste, a peculiar disagreeable odor, harder than silver, fusing at 1091° C. (1996° F.), and on cooling it crystallizes in regular octahedrons and cubes. It is combustible, and is readily oxidized at a red heat, forming black scales on the surface. On exposure to moist air, it acquires a filmy-green coating of subcarbonate of copper (or, if exposed to a salty atmosphere, of subchloride of copper), and has the specific gravity 8.914 to 8.952. As a conductor of electricity and heat it is one of the best we possess. Nitric acid readily dissolves it, but cold sulphuric, or even hot sulphuric acid (diluted) has no action on it. Copper forms with oxygen principally 2 oxides and 2 lines of salts, known as the cuprous (lower) and cupric (higher). The copper directed by the *British Pharmacopœia* is copper wire of about No. 25 gauge. In case of poisoning with copper after vomiting has been induced, and the stomach pump applied, albumen should be freely administered; also reduced iron, iron filings, or ferrocyanide of potassium (yellow prussiate of potash) in dilution, may be given. (For action of copper, see CUPRI ACETAS).

Alloys of Copper.—Copper forms many useful alloys, the principal of which are as follows: BRASS—Copper 64, zinc 36; BRONZE—Copper 80, tin 16, zinc 4; GUN METAL—Copper 90, tin 10; BELL METAL—Copper 78, tin 22; ALUMINUM BRONZE—Copper 95 to 90, aluminum 5 to 10; GERMAN SILVER—Copper 51, zinc 31, nickel 18. The proportion of zinc in brass, however, is not always that given above, but may vary from 28 to 36 per cent. In fact, the proportion of parts in all alloys vary within certain limits. Both the brass and bronze of the ancients contained lead in addition to the other metals. A good *statuary bronze* is made of copper 91, zinc 6, tin 2, lead 1.

Pigments Prepared from Copper.—Several copper pigments are employed in the arts and occasionally in medicine. Sometimes they are adulterated with barium, calcium, iron, lead and aluminum compounds.

SCHEELE'S GREEN. *Mineral green.*—A hydrogenated arsenite of copper ($CuHAsO_3$). Prepared by precipitating solution of sulphate of copper with that of potassium or sodium arsenite. A poisonous grass-green compound, insoluble in water. This compound, under the name *arsenite of copper*, has recently been employed in minute doses ($\frac{1}{100}$ gr. in water, fl℥vi; teaspoonful, frequently repeated), in *dysentery*, *cholera infantum*, and other *infantile diarrhœas.*

PARIS GREEN. *Schweinfurt green*, *Mitis green*, *Emerald green.*—Chiefly composed of aceto-arsenite of copper ($3CuAs_2O_4+Cu[C_2H_3O_2]_2$). A pale, grass-green, insoluble crystalline powder, the most poisonous of the cupro-arsenical compounds. It is extensively employed for the destruction of the Colorado potato beetle and other insects, and as a coloring material. It is prepared by boiling together arsenous oxide (As_2O_3) and verdigris.

BREMEN BLUE. *Bremen green.*—Usually hydroxide of copper, though the subcarbonate is sometimes sold for it. If used with oil, it turns green by forming a soap, but, if used with water only, it retains its blue color. Hence the two names.

BRUNSWICK GREEN may be either an oxychloride or an oxycarbonate of copper.

MOUNTAIN GREEN. *Mineral green* (Scheele's green is also called Mineral green).—Powdered malachite, or manufactured oxycarbonate of copper.

BLUE ASH.—A pigment prepared from the mineral *azurite* (*Mountain blue*), which is tricupric carbonate ($2[CO_3Cu]+Cu[OH]_2$). It is made by a secret method.

VERDITER.—Two copper preparations, known as *Blue verditer* and *Green verditer*, are used as pigments. The former is obtained by treating copper nitrate with chalk or with lime. If chalk be used, the product is a copper carbonate; if lime is employed, a mixture of calcium and copper hydroxides results. Green verditer is chiefly a mixture of copper carbonate, with an excess of chalky material. It is prepared by the interaction of copper nitrate and calcium carbonate, or white marl.

Other Copper Compounds.—CUPRUM AMMONIATUM. *Ammoniated copper*, *Cupri ammonio-sulphas*, *Ammoniæ cupro-sulphas*, *Cupro-sulphate of ammonia.* This salt is prepared by rubbing together until effervescence has ceased, 1 ounce of sulphate of copper with an ounce and a half of carbonate of ammonium; then place the residue in bibulous paper, and dry it on a porous brick. Finally, inclose in a well-stoppered bottle. The *U. S. P.* (1870) directed 3 parts of ammonium carbonate and 4 parts of copper sulphate, the product to be wrapped in bibulous paper, and dried by gentle heat. When prepared and made by the foregoing processes, the salt contains ammonium carbonate in excess. By dissolving 1 part of blue stone (copper sulphate) in 3 parts of ammonia water, and, after filtering, adding to the filtrate 6 parts of alcohol, the pure salt will crystallize either as a deep blue crystalline powder, or in the form of long, flat prisms and needles, having the composition $CuSO_4.(NH_3)_4.H_2O$. The salt has an odor of ammonia, and a nauseous, metallic taste. It dissolves in 1½ parts of cold water, but is decomposed in a large quantity of water, a pale-blue powder (basic sulphate of copper) being precipitated; excess of ammonia will prevent this. Exposed to the air, it loses its ammonia, a green powder resulting, which, being carefully heated, leaves a white residue, the neutral sulphate of copper. Acids, lime-water, and the fixed alkalies, form precipitates with a solution of the cupro-sulphate of ammonium; arsenous acid, in solution, gives a precipitate of Scheele's green. It is said to be a tonic, and has been used in *chorea*, *hysteria*, *epilepsy*, *spasmodic asthma*, and *cramp of the stomach*, in doses of from ½ grain, 2 or 3 times a day, cautiously increased to 5 grains. It is generally given in pill form, with crumb of bread and carbonate of ammonium. It is said, in doses of 2 grains, 3 times a day (after meals), to be an efficient remedy in *neuralgia of the fifth nerve*. The usual medicinal dose of this salt is from ⅛ to 1 grain. In solution (a drachm of the salt to a fluid ounce of water) it has been used as an application to indolent *ulcers* to stimulate them; and, still further diluted, to the eye, to remove slight *specks on the cornea*. In large doses it produces vomiting, purging, weakness, trembling, and paralysis. The antidotes are the same as named for poisoning by sulphate of copper.

Oleate of Copper.—This product has been found of service in many forms of *tinea trichophytosis*. It is employed locally as an ointment of from 1 to 5 grains to 1 ounce of petrolatum. It is antiseptic, astringent, and antiparasitic.

Cupri Oxidum, *Cupric oxide* ($CuO = 79.14$), *Copper monoxide*, *Black oxide of copper*.—This is found native as *melaconite*. It may be obtained by calcining well-washed and dried carbonate of copper (prepared by precipitating solution of blue vitrol with solution of sodium carbonate), and then by gradually heating it to redness in a Hessian crucible, the temperature being maintained about 30 minutes. When nearly cool transfer to glass-stoppered vials (Lloyd's *Chemistry*, p. 264). Black oxide of copper is a heavy, soft, amorphous powder, black in color, tasteless and odorless. It should dissolve, without effervescing, in diluted nitric acid, or other diluted acids that dissolve it. An ointment (4 parts to 30 of lard) has been used to discuss *chronic glandular enlargements*.

Copper Hydroxide, *Cupric hydrate* ($Cu[OH]_2$).—Prepared by precipitating a solution of copper sulphate with a solution of an alkali. It is a blue substance that dissolves in ammonia to form a dark-blue fluid (the aqueous solution of the cuprum ammoniatum above described), which is capable of dissolving linen, cotton, and other "modifications of cellulose" (Lloyd's *Chemistry*, p. 264).

Cupri Nitras ($Cu[NO_3]_2+3H_2O$), *Copper nitrate*, *Cupric nitrate*.—According to the *British Pharmacopœia* cupric nitrate is prepared by dissolving fine copper wire (about No. 25 gauge) in diluted nitric acid and crystallizing the salt, when the solution is sufficiently evaporated to admit of the formation of crystals on cooling not lower than 21.1° C. (70° F.). It crystallizes as dark-blue, deliquescent prisms of very corrosive action. It forms with ⅓ of its weight of water (at a low temperature) a tabular salt of the composition $Cu[NO_3]_2+6H_2O$. By absorption of atmospheric vapor, or on the addition of a slightly increased amount of water, it yields a styptic, corrosive liquid. Crystals of cupric nitrate corrode the skin with great energy, are soluble in water or alcohol, and fuse when heated, parting with water and nitric acid, and leaving a green basic salt, which, still further heated, becomes pure oxide of copper. This salt has been used as a caustic to *ulcers* of various parts, as well as of the tongue and throat; the ulcer must first be dried, then apply the caustic, and cover the part with sweet oil (Braithwaite's *Retrospect*, Vol. XXV, p. 201).

Cupri Chloridum, *Chloride of copper*, *Cupric chloride* ($CuCl_2+[H_2O]_2 = 134.2$).—This may be easily prepared in crystals by dissolving cupric oxide in chlorhydric acid, and evaporating the solution. The salt is deposited in rectangular prisms of a fine grass-green, or blue-green color. It is exceedingly acrid and caustic, has the specific gravity 1.67, is very soluble in water, attracts moisture from the air, forming an oily liquid, and fuses at a moderate heat, becoming solid when cold. In doses of from 2 to 10 grains, in the form of pill or solution, it is said to be useful in *epilepsy*. The solution may be used externally for the same purpose as that of the nitrate of copper.

Copper Carbonate.—This is the compound found on copper (copper rust), when the latter is exposed to the atmosphere. It is also known as basic carbonate and subcarbonate of copper. When freshly made, by precipitating copper sulphate solution with solution of sodium carbonate, the bluish precipitate has the composition $CuCO_3+Cu(OH)_2+H_2O$, but on drying the water escapes, leaving $CuCO_3+Cu(OH)_2$. It has a greenish color after drying, and has been used as a pigment under the name *mineral green*. It should dissolve completely in diluted acids with a green color, and in aqua ammoniæ with a blue color.

CUPRI SUBACETAS.—SUBACETATE OF COPPER.

Formula: $(C_2H_3O_2)_2Cu.CuO+6H_2O$. Molecular Weight: 196.68.

Synonyms: *Cupri subacetas*, *Cupric subacetate*, *Oxy-acetate of copper*, *Verdigris*, *Ærugo*, *Viride æris*.

Preparation.—Subacetate of copper, or *verdigris*, was formerly prepared chiefly in the southern parts of France. It is formed by exposing sheet copper to the action of the acetous fumes which are evolved in the process of wine-making. The refuse of the grapes placed in heaps, passes into the acetous fermentation, whereby the copper sheets are oxidized, and the oxide so formed unites with free acid. About the end of 4 or 6 weeks this is removed by scraping, and the plates are again exposed to the further action of the grape refuse. The paste-like substance which is thus formed, from time to time removed from the plates, is pounded with mallets of wood, and bagged in white leather, each bag weighing from 25 to 30 pounds. It may also be made by sprinkling vinegar over the copper.

Chemical Composition and Description.—Verdigris is an impure mixture of several basic acetates of copper. The method of preparation necessarily produces a substance of varying composition, containing more or less of foreign substances. The principal ingredient has the formula as given above.

Commercial verdigris occurs in the form of hard lumps of irregular shapes, greenish-blue or bluish-green, often interspersed with light-green blotches, and when freshly broken is of partially crystalline structure. It is heavy and earthy. To the taste it is nauseous, styptic, and coppery, and in powdered form has a disagreeable, acetous odor. Alcohol does not dissolve it, and water partially dissolves it, at the same time decomposing it, precipitating a deep-green, insoluble, tribasic acetate, which ultimately becomes black, while the neutral acetate remains in the solution. Verdigris is speedily blackened by hydrogen sulphide; diluted sulphuric acid, with the aid of heat, almost wholly dissolves it, from which solution no precipitate is caused by ammonia; hydrochloric acid dissolves it, with the exception of about 5 per cent of impurity; concentrated sulphuric acid decomposes it, evolving acetous fumes; ammonia dissolves all but its impurities, forming an intense violet-blue solution. The so-called "verdigris" observed on copper vessels when exposed to moisture, is not an acetate of copper, but a carbonate.

Action and Medical Uses.—Detergent and escharotic. Never used internally, but occasionally employed externally by some practitioners to remove *syphilitic verrucæ*, *fungous growths*, and *callous edges*, and as an application to obstinate *ulcers*, *ringworm*, *ringworm of the scalp*, *ophthalmia tarsi*, etc. The powder may be sprinkled on the surface, or it may be used in the form of ointment. It is best employed as an escharotic when deprived of its water of crystallization by heat, which leaves an efflorescent mass. Verdigris is poisonous, and when swallowed, is decomposed by zinc and copper filings, in the dose of from ½ to 2 drachms, followed by the free use of warm water, and afterward subduing the inflammatory symptoms by the usual means; or wheat flour, milk, and white of egg may be freely administered in water, or sugar and water, and vomiting be produced as speedily as possible.

CUPRI SULPHAS (U. S. P.)—COPPER SULPHATE.

FORMULA: $CuSO_4+5H_2O$. MOLECULAR WEIGHT: 248.8.

SYNONYMS: *Blue stone*, *Blue vitriol*, *Cupric sulphate*, *Cuprum vitriolatum*.

Preparation.—Sulphate of copper, or blue vitriol may be made by dissolving copper in diluted sulphuric acid, with the addition of nitric acid, evaporating and crystallizing. Metallic copper is scarcely acted upon by diluted sulphuric acid, even when warmed, but the addition of sufficient nitric acid to oxidize it causes it to readily dissolve. The nitric acid is reduced in this process, evolving vapors of nitric oxide (NO), which in contact with air, form red fumes of nitrogen peroxide (NO_2).

Description and Tests.—"Large, transparent, deep-blue, triclinic crystals, odorless, of a nauseous, metallic taste; slowly efflorescent in dry air. Soluble at 15° C. (59° F.), in about 2.6 parts of water, and in 0.5 part of boiling water; almost insoluble in alcohol. When carefully and continuously heated to 30° C. (86° F.), the salt loses 2 of its 5 molecules of water (14.43 per cent), and is converted into a pale-blue, amorphous powder. Two more molecules of water are lost at 100° C. (212° F.), while the fifth is retained until 200° C. (392° F.) is reached, when a white, anhydrous powder remains (63.9 per cent of the original weight). At a still higher temperature sulphur dioxide and oxygen are given off and a residue of black cupric oxide is left. The aqueous solution (1 in 20) has a blue color, and shows an acid reaction with litmus paper. If a drop of the solution be placed upon a bright piece of iron, it will produce a red stain of metallic copper. With potassium ferrocyanide T.S. the solution yields a deep reddish-brown precipitate. Barium chloride T.S. produces a white precipitate, insoluble in hydrochloric acid. If ammonia water be added to the solution, drop by drop, a pale-blue precipitate of cupric hydrate is formed which redissolves in an excess of ammonia water, forming a deep azure-blue solution, leaving no trace of residue undissolved (absence of iron, aluminum, etc.). If the aqueous solution (1 in 20) be heated to boiling with an excess of sodium hydrate T.S., until all of the copper has been converted into black cupric oxide, it will yield a filtrate which, after acidulation with acetic acid, should not be colored or rendered turbid by an equal volume of hydrogen sulphide T.S. (absence of arsenic, lead, zinc, etc.). If hydrogen sulphide gas be passed through 10 Cc. of the solution slightly acidulated with hydrochloric acid, until all of the copper is precipitated as sulphide, the filtrate should, on evaporation, leave not more than a trace of residue (limit of iron, aluminum, alkaline earths, etc.)"—(*U. S. P.*).

The *pulvis sympatheticus* of former times was the anhydrous white powder obtained by heating to about 200° C. (392 F.), while the *aqua sapphirina* was the deep-blue solution prepared by treating the pale-blue cupric sulphate with excess of ammonia. When less ammonia water is taken a green-blue precipitate of hydroxide of copper is formed, which dissolves if excess of ammonia is added, the well known deep-blue color resulting.

Action, Medical Uses, and Dosage.—Sulphate of copper in small doses is astringent and tonic; in large doses a prompt emetic. When the tissues are sound and intact it seldom acts as an escharotic. The earlier notions in regard to its toxic qualities are not now entertained, and death in fact seldom results from its employment even in large doses, though a gastro-intestinal irritation may persist for some time. Usually, however, recovery from overdoses is prompt. In small amounts copper is now deemed an important blood maker in certain *anemic conditions* (see *Acetate of Copper*). The emetic action of sulphate of copper is prompt and decided, and without nausea and the depression following many other agents. For *narcotic poisoning* it is quicker and just as safe an emetic as zinc sulphate, while the dose is smaller, from 3 to 5 grains. Occasionally, however, death results directly from sulphate of copper, gastro-intestinal congestion being the only discoverable post-mortem condition; when death has taken place some time after the ingestion of the salt, ulceration, sloughing, and perforation have been observed. The toxic symptoms of poisoning by this drug are: Headache, spasms, intestinal pain, vomiting, occasionally jaundice, collapse, and arrest of secretion of the urine.

In cases of poisoning by sulphate of copper, administer pure reduced iron, or iron filings, which reduce the copper in an insoluble condition, empty the stomach by means of the stomach pump or by hypodermatic injection of apomorphine, and give white of egg freely in sugared water. Treat the subsequent inflammation on general principles. Sulphate of copper is one of the many discarded remedies for *epilepsy*, and is said to be efficient, given in ¼-grain doses 3 times a day, in *quartan agues*. However, the salt is seldom used internally except as an emetic in *narcotic poisoning* and for *pseudo-membranous croup* after the false membrane has been thoroughly detached by other means. Prof. Scudder recommended it in the same class of cases in which he employed acetate of copper (see *Cupri Acetas*). Externally it is occasionally employed as an escharotic or stimulant; and is applied by some practitioners to *indolent ulcers*, *warts*, *callous edges*, *fungous growths*, *chancres*, etc., and as a styptic to *capillary hemorrhages*, and as a wash in some cases of *chronic ophthalmia*, *gonorrhœa*, *gleet*, and *leucorrhœa*, *stomatitis*, and *malignant sore throat*, and we have found the solution of a few grains very efficient in *rhus poisoning*, promptly checking extension, though considerable smarting is produced and a faint bluish discoloration of the skin may persist for several days. For the eye, as a collyrium, 2 or 3 grains to the fluid ounce of water, will be sufficient in ordinary cases. In *granulations of the lid* and other affections of the eye, it is often desirable to use sulphate of copper in pencil form; this may be effected in two ways, viz.: 1. Mix and briskly triturate together 4 parts of the pulverized sulphate and 1 part of pulverized borax; the water of crystallization given out unites them into a plastic mass, readily molded into pencils. 2. Mix together pulverized sulphate of copper 2 parts, pulverized ordinary potash alum 1 part; gradually melt them together in a porcelain vessel, and pour the fused mass into cylindrical molds of bronze or copper, to prevent the precipitation of metallic copper; the molds should have a diameter of about ¼ of an inch. Foltz does not favor the use of this remedy in eye disorders, believing other agents are as efficient and kindlier in action. He suggests, however, that it seems indicated in the transitional stage from *acute* to *chronic trachoma*, with pale, indolent follicles, and in old, chronic *trachoma*, with transverse, cicatricial bands across the conjunctiva, and the granulations undergoing atrophy (Webster's *Dynam. Therap.*, 575). A 10 per cent solution is favored to destroy *fungous* (*thrush*) *growths in the ear*, and to cauterize after removal of *tympanic cholesteatoma*. From 2 to 10 grains of the salt dissolved in a fluid ounce of water, according to the circumstances under which it is to be employed, will form a stimulating lotion. Sulphate of copper enters into *Fehling's Test Solution* for diabetic sugar. Dose as an emetic, 3 to 5 grains; internally, $\frac{1}{20}$ to $\frac{1}{2}$ grain.

Related Drug.—CUPRUM ALUMINATUM. *Aluminated copper, Lapis divinus.*—Fuse together in a porcelain vessel at a moderate heat, pure copper sulphate, alum, and potassium nitrate, of each, 17 parts. Add to this, stirring thoroughly, a mixture of camphor and alum, finely pulverized, 1 part each. Pour upon a slab or plate, and when cool break into pieces and preserve in well-stoppered containers.

CURARE.—WOORARI.

The poisonous preparation, Curare.

Source and History.—Curare is a frightfully poisonous extract, prepared by the savages of South America, for the purpose of poisoning the points of their arrows. It is known under various names, bearing a general resemblance, such as *woorari, woorara, curari, cururu, ourari, wourali*, etc. It is said to have been first brought to Europe by Sir Walter Raleigh. It was mentioned by the Fathers d'Acunja and d'Artieda, who visited the Amazon River in 1693 (*New Remedies*, 1877). In 1745, De la Condamine brought the poison to the notice of the French Academy. It was carefully described by Waterton (1812) (Waterton's *Wanderings in South America*), together with a process of preparation, as followed by the Macoushi Indians.

Regarding its origin authorities disagree, but it is known that different tribes vary the plants that enter into its composition, and thus we have little reason to doubt the conflicting statements of travelers. Waterton states that a vine called by the Macoushi Indians "Wourali," is the poisonous agent; although, according to him, they add the fangs of vipers, and plants that simply give bulk to the extract. Bancroft (1769) obtained from the Accawan Indians, a receipt for making it from native plants, under local names, and from one of these plants (woorara) the extract seemed to derive its name. According to a more recent authority, Dr. Jobert, the Tecuna Indians, at Calderao (Brazil), prepare curare from *Strychnos Castelnæi*, Weddell, *Cocculus toxiferus*, Weddell, *Didelphys cancrivora*, a plant belonging to the Arum family, known as "*Taja*," a plant of local name "Toucan's tongue," and three Piperaceæ of the genus Artanthe. These are extracted with water, and evaporated to an extract. According to Jobert, the *Strychnos Castelnæi* and the Taja are the most poisonous of the constituents (*New Remedies*, April, 1878, from *Bulletin de Therapeutique*). M. Planchon, in 1888 (*Jour. de Pharm. et de Chim.*, p. 539), summarizing what was known regarding the botanical origin of the various kinds of curare, states that the curare of the Amazon is derived from *Strychnos Castelnæiana*, Baillon (*S. Castelnæi*, Weddell); that of British Guiana from *Strychnos toxifera*, and that of French Guiana from *Strychnos Crevauxii* (named by Planchon). The curare of the Orinoco region, according to Gaillard's report, is of two kinds; one of weaker activity, from *Strychnos Gubleri*, used for hunting purposes, and another (strong curare) from *Strychnos toxifera*, a plant that extends over a vast territory in South America.

Description and Chemical Composition.—In appearance curare seems to differ according to its origin and its age. Sometimes it is described as a syrup, into which the points of the arrows are dipped; again, it is of a hard, resinous appearance. It is, in reality, simply a vegetable extract, and may be expected to vary as much as other extracts; and we know that time and mode of preparation will change the general appearance of all solid extracts. In quality also, it is uncertain; according to Blodgett (1878), the most active article presented a glistening fracture, and was of a dark-brown color. Doubtless, those specimens which contain the largest proportion of the extract from the species of *Strychnos*, or of *Cocculus toxiferus*, are most poisonous. Although, in 1828, Roulin and Boussingault announced the poisonous principle to be *curarine*, yet, for some years afterward, it was erroneously believed by many that curare depended upon strychnine and brucine for its poisonous property, for Oberdörffer had announced that woorara, from three sources, yielded both strychnine and brucine, and Wittstein stated that both alkaloids are present in woorara from Brazil, and in the wood of *Strychnos toxifera*, Schomburghk. It is generally accepted, at the present day, that curare contains curarine, a very poisonous substance, resembling strychnine in some respects, but differing quite markedly in others.

Curare is of a bitter taste, soluble in cold water to the extent of about 75 per cent, which fluid also extracts the poisonous substance known as curarine. *Curarine* ($C_{18}H_{35}N$) (Sachs) is an alkaloid, and was discovered by Roulin and Boussingault. It is colorless or white, of a bitter taste, deliquescent to a certain extent in moist air, soluble in water, and in alcohol, less soluble in chloroform, and insoluble in pure ether, benzol, oil of turpentine, and disulphide of carbon. It has an alkaline reaction, and unites with acids to form crystallizable salts. According to Sachs, it exists naturally as a sulphate. It may be separated from strychnine, if mixed with that alkaloid, by benzin, in which substance, according to Flückiger, curarine is insoluble. According to R. Böhm (1887) curarine is yellow and neutral in reaction. Its aqueous solution is fluorescent (greenish) and when evaporated, after the addition of a mineral acid, yields non-toxic, acicular crystals. Curare when treated with water, leaves from 5 to 50 per cent of a residue; the solution contains large amounts of another alkaloid of a non-poisonous character, soluble in diluted sulphuric acid, and named by Böhm *curine*. By treatment with iodide of methyl, curine yields an alkaloidal body exhibiting the poisonous activity of curare itself. *Curine* is amorphous, but may be crystallized from ethereal solutions. It is little soluble in water, but easily soluble in alcohol (*Jahresber. der Pharm.*, 1887, p. 415).

Action, Medical Uses, and Dosage.—Curare, or woorara, produces its poisonous effects only when it has penetrated into the circulation, either by means of a wound, by rectal injection, or by inhalation (Pelouze and Bernard). When applied to the skin it powerfully irritates. It first paralyzes the voluntary and then the involuntary muscles, death, when it occurs, being due to respiratory paralysis. It is seldom toxic when introduced into the stomach, although it would be prudent to use some care in its internal administration, as fatal results are stated to have followed its ingestion in maximum doses, or when taken upon an empty stomach. However, saccharine urine and profuse perspiration are said to have been produced by its internal administration. The symptoms following its introduction into the circulation are muscular paralysis (which, more or less rapidly, becomes general), stupor, suspended respiration, sometimes convulsions, and death, the heart continuing to act for some time after all other indications of life have disappeared. It is stated that animals have recovered from its effects, even at this stage, artificial respiration having been resorted to before the heart had wholly ceased its action. The difference in the character, and in the rapidity of the symptoms observed in poisoning by this agent, is supposed to be due to a difference in its composition, and to its more or less rapid expulsion through the urinary organs. The causes of the phenomena produced by it are not satisfactorily determined; they have been variously attributed to paralysis of the respiratory nerve centers, and of the motor nerves; to a primary and direct action upon the heart; to a primary influence upon the nerve terminations, etc. It has no effect upon the pulse or physical temperature, and no perceptible change has been observed in the character of the blood nor in that of the solid textures; hence it can not be a blood poison.

Vella (*Pharm. Jour.*, 2d series, Vol. II), in 1861, decided that strychnine and the poisonous principle of curare, antidoted each other, basing his assertions upon actual experiments, in which large doses of both substances were administered to dogs without fatal effect, while afterward the same amount of strychnine alone, resulted in death, but caution must certainly be observed in the use of so powerful a poison, even in the way of an antidote. In the *N. Y. Med. Gaz.*, July, 1855, Drs. Brainard and Green announced that a solution of iodine 1 part, iodide of potassium 2 parts, and water 48 parts, acts as an antidote to the poison when the antidote is injected under the skin, and neutralizes it when mixed with its solution. Extreme care must be employed both in handling and administering so deadly a substance. It should by no means be permitted to come into contact with a cut, abrasion, or scratch; indeed, it were safer never to handle it with the naked fingers; neither should we attempt to pulverize the dry article, as its inhalation is dangerous. Mr. H. S. Wellcome exhibited, at the meeting of the American Pharmaceutical Association, held in Indianapolis, Ind., 1879, arrows brought by himself from South America and poisoned by the Indians with curare. These arrows had been dipped into a *paste* (soft extract), about $\frac{1}{2}$ an inch of each point being covered with the poisonous extract. Mr. Wellcome informed Prof. Lloyd that the natives could antidote the poison if treatment was instituted at once, but that they refused to name the antidote.

The therapeutical employment of curare has been suggested in certain severe and obstinate spasmodic affections, as in *epilepsy*, *chorea*, *hydrophobia*, and, more particularly, in *tetanus*. It is used by subcutaneous injections of its filtered aqueous solution, thus: Add curare 1 grain, to distilled water 24 minims; dissolve, let the solution stand 48 hours, and filter; of this, from 2 minims ($\frac{1}{12}$ grain) to 6 minims ($\frac{1}{4}$ grain) may be used at one injection, carefully repeating the injections until relaxation of the muscles has been effected. Curarine, dissolved in water, with a few drops of sulphuric acid added, to facilitate its solution, is to be used in still smaller doses—from the $\frac{1}{240}$ to the $\frac{1}{120}$ part of a grain. It is doubtful whether this agent will ever come into general use as a medicinal remedy; at least, not so long as other medicines are known in which greater confidence can be placed. The diversity of action, attributable, in some instances, to its difference of composition, in others to its inertness, or to its highly active qualities, render it an uncertain, as well as an unsafe, remedy.

Related Substances.—*Musculus venenosus, Mussel.*—Owing to the presence probably of certain ptomaines, some mussels are poisonous, or, at least, edible mussels may become occasionally toxic, as, when kept in filthy water, abounding in amœba, bacteria, etc. Brieger has shown that one of these animal bases (*mytilotoxine*, $C_6H_{15}NO_2$) has physiological actions similar to curare. Mussels are rendered non-toxic by being boiled in weak alkaline solutions. (For an interesting account of this subject, see Vaughan and Novy's *Ptomaines, etc.*, 1896).

Malouetia nitida, Guachamacà.—A Venezuelan plant containing *guachamacine*, an alkaloid identical, according to Kobert, with *curarine* (*A. J. P.*, 1885).

CHINOTOXINE, or *Dichinolindimethylsulphate.*—A new synthetic product is reputed to act like curare.

CURCAS PURGANS.—PURGING-NUT.

The seeds of *Curcas purgans*, Adanson (*Jatropha Curcas*, Linné).

Nat. Ord.—Euphorbiaceæ.

COMMON NAMES: *Purging-nut*, *Physic-nut*, *Barbadoes-nut*.

Botancial Source.—A large shrub, with a milky juice, and leaves that are heart-shaped, smooth, 5-lobed, and borne on leaf-stalks 2 or 3 inches long. The flowers are small, green, monœcious and in axillary, stalked cymes. The corolla and calyx are 5-parted, and the male flowers have 10 stamens. The ovary is 3-lobed, 3-celled, and has a 3-parted style. The fruit is a fleshy black berry, and contains 3 seeds, about an inch in length. The kernel is oily, inodorous, sweetish to the taste, followed by acridity.

History.—This is a large, thick-stemmed, lactiferous shrub, a native of the Cape de Verd Islands (Pickering), but cultivated as a hedge plant, as well as for its oil, and has also been naturalized in the West Indies, South America, and in most parts of the tropics. The plant was formerly referred to *Jatropha*, from which it differs in having a monopetalous corolla. The seeds are called *Purging-nuts*, *Nuces catharticæ Americanæ*, *Semina ricini majoris*, *Semen curcadis*, *Ficus infernalis*, *Nuces Barbadenses*, *Physic-nut*, etc., (*New Remedies*, 1878, from *Zeitschrift des Oesterr. Apoth. Vereins*), and affords an oil, upon pressure, which is a drastic cathartic, and which has been used to adulterate croton oil.

Description.—The seeds are about 1 inch long, oval, flattish on one surface, rounded on the opposite, each side presenting a slight elevation, running lengthwise. It has a fissured testa of a blackish color. Taste at first sweet, afterward acrid. It has no odor and contains oil.

Chemical Composition.—The oil was examined by M. J. Bouis (1854) (*Comptes Rendus*, Vol. XXXIX) who obtained it from the nuts, by pressure, to the amount of 37 per cent. It is white, has a density of 0.910 at 16.5° C. (62° F.), is almost insoluble in alcohol, easily saponified by soda, forming a white, hard soap. It is decomposed by heat, yielding, among other products, sebacic acid. When saponified by potash, if the resulting soap is decomposed by hydrochloric acid, a mixture of fatty acids is produced, from which, by pressure, from 18 to 20 per cent of a white, solid acid may be separated. This is soluble in hot alcohol, from which, on cooling, it is deposited in brilliant spangles. From its close resemblance to cetic acid (from spermaceti), Bouis named it *isocetic acid*. August Siegel, of Dorpat, who more recently (1893) investigated the seeds of *Curcas purgans*, found isocetic acid to be a mixture of palmitic and myristic acids, and isolated a peculiar fatty acid of the formula $C_{1}H_{2}O_{3}$, which he called *curcinoleic acid*. Besides, he obtained from the seeds, previously deprived of their fatty oil, a toxic albuminoid substance, soluble in water and resembling the poisonous principle of *Amanita phalloides*. It was named *curcin*, and becomes inert when exposed to temperatures above 50° C. (122° F.), or when treated with precipitants. The percentage composition of the seeds was found by Siegel as follows: Water, 7.2; ash, 10.2; oil, 33.86; sugar, coloring matter, cellulose, 47.83; albuminoids, 1.71 (*Amer. Jour. Pharm.*, 1893).

Action, Medical Uses, and Dosage.—The seeds of Purging or Barbadoes-nut occasion emetic and drastic cathartic effects, accompanied with a burning sensation in the fauces and stomach, and other unpleasant, and even serious, symptoms. However, if the seeds be entirely deprived of their embryo, the emesis and other disagreeable sensations do not occur. The juice of the leaves acts as a rubefacient, and has been successfully employed, in the countries where the shrub grows, as a local application in *rheumatic pains*, in certain *eruptive affections*, and in *piles*. The oil, in the dose of 10 or 12 minims, is a cathartic, somewhat resembling croton oil in its action, though less severe. It may be used in all cases where the employment of croton oil is indicated.

Related Species.—*Curcas multifidus*, Endlicher (*Jatropha multifida*, Linné). South America. The seeds resemble somewhat the Barbadoes nut and yield an oil probably identical with that from the seeds of *Curcas purgans*.

Anda Gomesii, Jussieu (*Joannesia principis*, Vellozo; *Anda brasiliensis*, Raddi). The *Anda-assú* tree of Brazil, yielding purgative brown, chestnut-like seeds, having the taste of peach-kernels. The seeds act violently as a purgative, and may even act as an emeto-cathartic. The reddish, limpid oil, of which the seeds yield about 50 per cent, is also actively cathartic. By preparing the seeds in emulsion, the germ and testa being first removed, a griping constituent is avoided, and the oil may be used in the place of castor oil, the action of which it closely resembles. Doses of ℥ii to ℥iii act gently and efficiently. Large doses harshly overact.

Jatropha macrorhiza. *Jicama* (Euphoriaceæ).—Northern Mexico and Texas. An active purgative in overdoses; a mild evacuant and cholagogue in doses of ½ drachm to 2 fluid drachms of the fluid extract.

CURCUMA.—TURMERIC.

The rhizome of *Curcuma longa*, Linné (*Curcuma rotunda*, Linné; *Amomum Curcuma*, Jacquin).

Nat. Ord.—Zingiberaceæ.

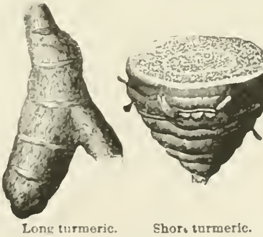
Common Names: *Turmeric* (long and round), *Curcuma*.

Illustration: Bentley and Trimen, *Med. Plants*, 269.

Botanical Source.—This is a perennial plant, with the roots or tubers oblong, palmate, and deep-orange inside. The root-leaves are about 2 feet long, lanceolate, long-petioled, tapering at each end, smooth, and of a uniform green color. The petioles are sheathing. The spike is erect, central, oblong, and green. Its flowers are dull yellow, arranged 3 or 5 together, surrounded by bracteolæ (L.).

History.—Turmeric is indigenous to several parts of southern and eastern Asia, and is extensively cultivated in China, Hindustan, and other countries, where it is propagated from cuttings of the root. Several varieties are found in commerce, their names being derived from the countries producing them. Thus we have *Chinese*, *Madras*, *Bengal*, *Java*, and *Cochin turmerics*. The latter is thought to be derived from another species than *Curcuma longa*, Linné, and though never

Fig. 90.



Long turmeric. Short turmeric.

used as turmeric in Cochin, the natives obtain from it a variety of arrow-root. The other varieties differ somewhat, though in general not enough to be noticed by inexperienced persons. The Chinese turmeric is generally preferred. Java turmeric is the least valuable, and is the product of *Curcuma longa*, var. *minor*, Hasskarl. Curcuma is chiefly used as a condiment and for dyeing; the Bengal variety, which is of a deeper color, being generally preferred for the latter purpose. While the foregoing varieties of curcuma are recognized, the drug is generally distinguished in commerce by the terms *long* and *round turmeric*. The latter is the central or primary rhizome of the plant, while the former consists of the lateral or secondary rhizomes. Turmeric is largely used in the preparation of *Turmeric Test Paper*, and also for coloring table mustard and some other food products.

Description.—*Long turmeric* (*curcuma longa*), when dry, is in slightly curved, subcylindrical, or oblong tubers, about 1 to 3 inches in length, and from ¼ to ½ inch in diameter, often pointed or tapering at one end, yellowish externally, with transverse, parallel rings, internally deep-yellow or reddish-brown, marked with shining points (due to immersion in scalding water in order to facilitate the drying process), dense, solid, having a short, granular fracture, and forming a lemon-yellow powder. *Round turmeric* (*curcuma rotunda*), differs in being ovate, pear-shaped, or subspherical, occasionally pointed and crowned with leaf remains at the upper end. They are from 1½ to 2 inches long, and from ¾ to 1½ inches in diameter. Turmeric has a peculiar, somewhat fragrant odor, and a bitterish, slightly acrid taste, like that of ginger, exciting a moderate degree of warmth in the mouth, and communicates a yellow color to the saliva. It yields its properties to water or alcohol.

Chemical Composition.—The yellow coloring matter, *curcumin*, was first obtained (impure) by Vogel and Pelletier; more recently it was prepared in pure and crystalline form by Daube (1870), and contemporaneously by Ivanow-Gajewsky. It was further studied and some derivatives of it prepared by C. Loring Jackson and A. G. Menke, in 1882–83, who determined the formula $C_{14}H_{14}O_4$. These chemists obtained it from the root by first removing the fatty and volatile oil by means of ligroin, which removed 11 per cent of the weight of the root, then abstracting curcumin (contaminated with resins), by means of ether, and repeatedly crystallizing from alcohol until the melting point became constant, viz.: 178° C. (352.4° F.). The yield was 0.3 per cent. As thus obtained, *curcumin* crystallizes in amber-yellow prisms, appearing orange-yellow in reflected light, insoluble in water and diluted acids, sparingly soluble (1 in 2000) in benzene (Daube's solvent, which refuses to dissolve the resins); easily soluble in ether, chloroform, and alcohol; also in diluted alkaline solutions with a striking red-brown, fluorescent color. It is partly soluble, with crimson color, in concentrated acid solutions. Non-alkaline solutions exhibit green fluorescence. Chemically, curcumin is a substituted aromatic oxyacid, yielding *vanillin* with weak oxidizers, and *protocatechuic acid* when fused with caustic potash.

Filtering paper saturated with an alcoholic solution of *curcumin* and dried, reacts like *turmeric tincture* (see below) towards acids, alkalies, and boric acid. It turns red-brown with alkalies which color becomes violet upon drying; the yellow color is restored with acids. When the paper is dipped into solution of boric acid, it turns orange-red (upon drying), and remains so even when it is afterward moistened with free mineral acid. Paper that has been turned to orange by boric acid will assume a blue color when it is moistened with diluted alkali. Schlumberger (1866) obtained crystalline *rosocyanin* by heating an alcoholic solution of curcumin and boric acid with mineral acids and then allowing the blood-red solution to cool. It is insoluble in water, but soluble in alcohol, this solution turning blue upon the addition of an alkali.

A red compound of curcumin with boric acid was obtained in the form of a precipitate by the same author, by adding water to a mixture of alcoholic curcumin and boric acid; boiling water removed therefrom all the boric acid, leaving a yellow resin which he called *pseudo-curcumin*. Strong sulphuric acid forms with curcumin a solution of crimson color, which color disappears upon dilution with water, a precipitate of yellow flakes resulting.

About 1 per cent of an acrid *volatile oil* is present in curcuma root, one constituent of which, called *turmerol*, was isolated, in 1883, by C. L. Jackson and

A. G. Menke, the boiling point being about 193° C. (379.4° F.). It has a pleasant aromatic odor, is lighter than water, and is oxidized by means of potassium permanganate to *terephthalic acid* ($C_6H_4[COOH]_2$). The presence of alkaloids in curcuma root was indicated by Ivanow-Gajewsky and by J. Cook. Kachler, in 1870, obtained considerable amounts of acid potassium oxalate from an aqueous infusion of the root.

TURMERIC TINCTURE and TURMERIC PAPER.—Turmeric is much employed as a test for alkalies, which render it reddish or brownish; white bibulous paper or paper not sized, is brushed over with the tincture or decoction, or dipped into one of them, and dried in a neutral atmosphere (see *Reagents and Test Solutions of U. S. P.*, *No.* 59).

Action, Medical Uses, and Dosage.—Turmeric is a mild, aromatic stimulant, but is seldom used in this country, except to color ointments and pharmaceutical mixtures.

Related Product.—*Murraya Kœnigii* (*Nat. Ord.*—Rutaceæ), *Curry leaves.* The leaves of this tree, which grows wild in the mountains of the western coast of India, are quite extensively used as a condiment. They enter into the mixture known as *Curry powder*, largely used in pickling and cooking. In India the leaves are regarded as tonic and stomachic, and are given raw in *dysentery* and applied externally in *skin eruptions.* The Hindus employ an infusion of the leaves to check *vomiting* (Ainslie). The root is stimulant, and is in repute as a remedy for the *bites of venomous animals* (Dymock, *Mat. Med. of Western India*). An essential oil, two resins, and a bitter glucosid, *kœnigin*, were obtained from the leaves. *Simabolee oil* is obtained from the seeds. The white, sweet-odored flowers of *Murraya exotica* (cultivated), yielded (De Vrij) the glucosid *murrayin*, ($C_{18}H_{22}O_{10}$) (Dymock).

CUSSO (U. S. P.)—KOUSSO.

"The female inflorescence of *Hagenia abyssinica* (Bruce), Gmelin"—(*U. S. P.*). (*Brayera anthelmintica*, Kunth; *Banksia abyssinica*, Bruce).

Nat. Ord.—Rosaceæ.

COMMON NAMES: *Kooso, Cusso, Kousso, Kusso, Kosso, Cossoo.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 102.

Botanical Source.—This is a tree growing about 20 feet high, with round, rusty, tomentose-villose branches, marked by the annular cicatrices of the fallen leaves. The leaves are crowded, alternate, interruptedly imparipinnate, and sheathing at the base. The leaflets are oblong, or elliptical-lanceolate, acute, serrate, villose at the margin and on the nerves of the under surface. The stipules are adnate to the petiole, which is dilated at the base, and amplexicaul. The flowers are diœcious, small, greenish, becoming purple; repeatedly dichotomous; and with pedicels with an ovate bract at the base. The so-called male flowers may be regarded as hermaphrodite flowers, inasmuch as the carpels are well developed. Female flowers somewhat different in their structure. The outer segments of the calyx are much more developed than in the female flowers, are 4 or 5 times larger than those of the inner row, and placed somewhat below them; the petals are entirely wanting; the stamina are rudimentary and sterile. The ripe fruits are unknown (Kunth).

History.—This plant was introduced into notice by a pharmacist of Paris, and its properties as an anthelmintic were investigated by the Academy of Medicine and the Academy of Sciences as early as 1847. It grows in Abyssinia, the flowers being the parts of the plant used. They are reduced to a fine powder, which is brownish, like jalap, bitter, somewhat nauseous, and possessed of an odor similar to scammony. The flowers, not powdered, have a somewhat fragrant odor, and a slight taste, which soon becomes nauseous and acrid. The plant was named in honor of Dr. Brayer, who first made its virtues known in Europe. Bruce, in his *Travels*, Vol. VII, appendix, gives a minute description of the plant, and calls it, in testimony of esteem for a friend, "*Banksia abyssinica.*" Dr. Kirk, in the appendix to the second volume of the "*Highlands of Ethiopia,*" by Sir W. C. Harris, calls it "*Hagenia abyssinica,*" and states "that a cold infusion of the dried flowers and capsules, constitutes the famous drasticum purgans and anthelminticum of the Abyssinians." Both the male and female inflorescence are collected, though the latter only are official in the *U. S. P.* The dried male flowers are of a pale, greenish-brown hue, and are frequently termed *kooso-esels.* The commercial female flowers are of a light, brown-red color, and are known as *red kooso.* The inflorescence is collected before the ripening of the fruit, forming loose, dried panicles, which, as found in commerce, are often considerably broken.

Description.—The *U. S. P.* thus describes the official cusso: "In bundles, rolls, or compressed clusters, consisting of panicles about 25 Cm. (10 inches) long, with a sheathing bract at the base of each branch; the two roundish bracts at the base of each flower, and the 4 or 5 obovate, outer sepals are of a reddish color, membranous and veiny; calyx top-shaped, hairy, enclosing 2 carpels or nutlets; odor slight, fragrant and tea-like; taste bitter, acrid, and nauseous"—(*U. S. P.*).

Chemical Composition.—Wittstein found the flowers to contain gum, wax, bitter acrid resin, sugar, tasteless resin, fatty matter, chlorophyll, tannin, and lignin. The first-named resin is identical with *koussin.*

A preparation named koussin was made by M. Pavesi and M. Vée, according to the following process: Treat kousso (300 parts) with alcohol (100 parts), and calcium hydrate (25 parts), at a temperature of 60° to 65.5° C. (140° to 150° F.). Also digest the residue with barley water (600 parts). Mix the solutions thus obtained, filter, and precipitate by means of acetic acid. The koussin thus obtained is yellow, bitter, resinous, non-crystallizable, and insoluble in cold alcohol. Merck obtained it in well-defined rhombic crystals of sulphur-yellow color, readily dissolving in chloroform, ether, carbon disulphide, and benzol; less soluble in glacial acetic acid, and alcohol of specific gravity 0.818, and not at all soluble in water. Flückiger (*Pharmacognosie*, 1891) states that koussin crystallizes best on cooling its solution in concentrated sulphuric acid, saturated at 15° C. (59° F.). It is dissolved by alkalies, while acids reprecipitate it, unaltered, as an amorphous, white mass, which may be again obtained in crystals from solution in hot alcohol. Koussin is not chemically altered by cautiously melting it; in this condition it remains as a yellow, amorphous, transparent mass, which, if simply touched with a minute portion of alcohol, instantly assumes the form of stellate, crystalline tufts. When treated with concentrated sulphuric acid, if water is added to the solution, amorphous white koussin is precipitated. If the (yellowish) solution of koussin in concentrated sulphuric acid is allowed to stand for a few days, or if it be carefully warmed, a scarlet-red coloration makes its appearance, *isobutyric acid*, but not sulphurous acid, being formed as a by-product. On diluting the red solution with water, purple-red amorphous flakes are precipitated. These vary in composition from $C_{22}H_{21}O_{10}$ to $C_{23}H_{22}O_{10}$. Flückiger and Buri assign to Merck's koussin the composition $C_{31}H_{38}O_{10}$ (*Pharmacognosie*, 1891). This principle has been variously termed *kousin*, *kosin*, *koosein*, *brayerin*, and *tæniin*. It is notable that the *pure kousin* is not so active an anthelmintic as the amorphous product obtained by Pavesi's method.

Action, Medical Uses, and Dosage.—Purgative and anthelmintic. Used by the Abyssinians for *tapeworm*, to which they are very subject, and it is said they will not travel without having some of the kousso with them. The dose of the flowers in powder is a small handful, or about 4½ drachms, which is to be macerated in about 3 gills of lukewarm water for 15 minutes. The infusion, with the powder suspended in it, is taken either in 1, 2, or 3 doses, quickly following each other. It is recommended that lemon-juice, or tamarind water, should be taken freely before and after the kousso. The patient must be prepared by a low diet for 1 or 2 days previously, and by a dose of castor oil, or other purgative, and the kousso is to be taken on an empty stomach early in the day. The clear infusion has the color, and a somewhat similar taste, of very weak senna tea. Its operation is safe, speedy and most effectual, rarely causing any annoyance or uneasiness, except a slight nausea, and this but seldom; occasionally emesis takes place, or diuresis. A gentle cathartic after its operation is also advisable. As far as it has been used, when fresh, it has not failed to kill and expel the worm.

CYCLAMEN.—CYCLAMEN.

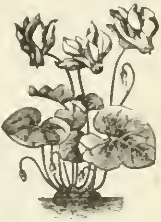
The tuber of *Cyclamen hederæfolium*, Willdenow (*Cyclamen europæum*, Miller). *Nat. Ord.*—Primulaceæ.

Common Names: *Sow-bread, Hog's-bread.*

Illustration: *Botanical Magazine*, Plate 1001.

Botanical Source and History.—Cyclamen hederæfolium is a native of Italy and Sicily, and is occasionally found naturalized in the wet, clayey soil of England. The leaves are all radical, on slender leaf-stalks; they are heart-shaped, finely-toothed on the margin, and variegated with light and dark-green color. The flowers are solitary and nodding, on long, slender stalks; they closely resemble the flowers of the American cowslip (*Dodecatheon Meadia*). The corolla is monopetalous, with a very short tube, and a large, reflexed, 5-parted limb, which gives the flower an odd appearance. The fruit is a many-seeded, 5-valved capsule. After flowering, the slender flower-stalk twists into a spiral curl, and, bending over, ripens the seed vessel on the surface of the ground. On account of the graceful little flowers, this and other species of Cyclamen, are often found in cultivation. The tubers of *C. europæum*, Linné, and of *C. persicum*, Miller, are also used, and the various species have been employed in medicine from an early period. Pliny and Dioscorides advised the root as a curative agent in numerous affections. It occupied a place in the *Pharmacopœia Londonensis* (1653), under the name *Artanitæ cyclaminis*, and in Lewis' *Materia Medica* (1761), as *Arthanita*. It was official in Germany about 120 years ago.

Fig. 91.



Cyclamen europæum.

Description and Chemical Composition.—The green root is an orbicular, flattened tuber, brown externally, white within, with blackish radicles. It contains about 80 per cent of moisture, and ½ per cent of ash. The constituents are saccharine matter, starch, gum, and *cyclamin* (M. de Luca), which is the poisonous principle of the tuber. *Cyclamin* was first obtained by Saladin, and named by him *arthanitin*. To prepare it, exhaust the dried and powdered tubers with alcohol; filter this tincture, evaporate to dryness, extract the residue with alcohol; and then permit the solution, after filtration, to evaporate spontaneously in a cool, dark place. Whitish amorphous aggregations of cyclamin will be deposited, which may be purified by re-solution in hot alcohol, and subsequent evaporation over sulphuric acid (*Comptes Rendus*, 1857).

As obtained by M. de Luca, *cyclamin* ($C_{20}H_{34}O_{10}$), is white, amorphous, opaque, inodorous, friable, neutral, and of an acrid taste. It absorbs moisture in damp air, becomes gelatinous in a small quantity of cold water, and dissolves in 500 parts of this fluid, rendering the liquid frothy, like soap-suds. In aqueous solution, it is coagulated by a temperature of from 60° to 77° C. (140° to 170° F.), but the coagulated matter redissolves after a few days. It readily dissolves in hot alcohol, acetic acid, wood spirit, and glycerin, but is insoluble in chloroform, ether, oils, and disulphide of carbon; tannin precipitates it from its solutions. By the action of boiling diluted acids, glucose is formed, and a body called *cyclamiretin* ($C_{15}H_{22}O_2$); hence it is a glucosid. For further details regarding these substances, see Husemann and Hilger (*Pflanzenstoffe*). Both cyclamin and the juice of the tuber are poisonous to man and fish, but the tubers are sought for and eaten by hogs with impunity, thus giving rise to the vulgar names applied to the plant —"sow-bread," or "hog's-bread." Cyclamin, the chief active principle of this plant, has not been employed therapeutically; administered to small animals, it has occasioned their death in a few days. Its action has, by Bernard, been compared to curarine; and to saponin, senegin and smilacin, by Schroff.

Action, Medical Uses, and Dosage.—The root or tuber of cyclamen, in its recent state, is a drastic cathartic, for which purpose it has been long in use among the peasantry of some parts of Europe. Its effects, however, are frequently very severe, as violent emesis, hypercatharsis, intestinal inflammation, cold sweats, tinnitus aurium, spasmodic movements, etc., which sometimes result in death. This severity of action is lessened by drying the tubers. In the dried state, 8 or 10 grains of the powder, rubbed up with an equal quantity of starch or gum, will have a purgative effect. Formerly, an ointment was prepared from the fresh tubers, "ointment of arthanita," which was rubbed upon and around the umbilicus of children, for the expulsion of *worms*, upon the abdomen of adults to cause emesis, and upon the region over the bladder to increase the urinary discharge. The fresh tubers, bruised and formed into a cataplasm, have been employed as a local stimulating application to *indolent scrofulous swellings*, *abscesses*, etc.

Prof. Scudder (*Spec. Med.*) states that the tincture is prepared from the tuber in early spring, or during the period of rest of the plant. He suggests a tincture to be made from the tubers of hot-house plants The special uses to be made of this tincture are to arrest severe *emesis*, particularly that depending upon brain disease, vertigo, tendency to fainting, inability to walk straight, and *diarrhœa*, with tormina and tenesmus. Tincture of cyclamen (℥viii to alcohol Oj) gtt. v to aqua fl℥iv; teaspoonful every hour. Dose of powder. 5 grains; of decoction (ʒi to ʒiii, in aqua Oj), 1 to 4 fluid drachms.

CYDONIUM.—QUINCE-SEED.

The seeds of *Cydonia vulgaris*, Persoon (*Cydonia europæa*, Savi; *Sorbus Cydonia*, Crantz; *Pyrus Cydonia*, Linné).

Nat. Ord.—Rosaceæ.

Common Name: *Quince-seed.*

Illustrations: Köhler's *Medizinal Pflanzen*, Vol. I, Plate 34; Bentley and Trimen, *Med. Plants*, 106.

Botanical Source.—This is a well-known shrub or tree, from 8 to 20 feet high. The leaves are oblong-ovate, obtuse at base, acute at apex, entire, smooth above, and tomentose beneath. The flowers are solitary, white with a purple tinge, large, and terminal. The pome or fruit is tomentose, obovoid, yellow when ripe, having a peculiar fragrance, and an austere, acidulous, astringent taste; cells 5; seeds many, in a thick, soluble mucus (W.—L.).

History.—The quince tree is a native of Candia, but is cultivated extensively in this country and Europe, and its fruit is much employed in making jellies, preserves, etc. It grows wild in the forests north of Persia, not far from the Caspian Sea, and south of Caucasus, and also in Anatolia (De Candolle, *Origin of Cultivated Plants*, 1882). De Candolle also states that the fruit has been but little modified by cultivation, being as harsh and acrid yet as when known to the ancient Greeks. The parts used in medicine are the seeds.

Description and Chemical Composition.—The seeds are ovate, acute, flat on one side, convex on the other, being compressed triangularly, brown externally, with a reddish tinge, internally white, odorless, and of a bland, mucilaginous taste when whole, but when the testa is removed from the dicotyledonous embryo, the taste of the latter is somewhat like that of bitter almonds. The external coat of the seeds is composed of very fine cells, in which is lodged a large quantity of mucilage, which is taken up by cold or hot water. The decoction, evaporated to dryness, and powdered, will form a proper mucilage with water, in the proportion of 3 grains to the fluid ounce. One part of it gives a semi-syrupy consistence to 1000 parts of water. Pereira proposed to call this mucilage *cydonin;* he considered it a peculiar variety of gum, which, like arabin, being soluble in cold or boiling water, is different from cerasin and bassorin. This mucilage gelatinizes with perchloride of iron, but, unlike that principle, it is not affected by silicate of potassium. It has but little adhesive qualities, contains albumen and calcium compounds, is precipitated by alcohol, mercuric chloride, zinc chloride, neutral and basic acetate of lead, but is unaffected by sodium biborate in solution. Its composition is $C_{18}H_{28}O_{14}$ (Kirchner and Tollens, 1875), and it may be obtained in a dry state to the extent of 20 per cent. Oxalic acid may be derived from it by treatment with nitric acid. The cotyledons contain fixed oil, and malic acid is present in the fruit to the extent of 3 to 3.5 per cent. Sixty grains of quince seeds will make a thick mucilage in 30 minutes, of 8 fluid ounces of water.

Action, Medical Uses, and Dosage.—Decoction of quince seeds forms a demulcent mucilage, very useful in *gonorrhœa*, *dysentery*, *aphthous affections*, and *excoriations* of the mouth and fauces; also as a collyrium in *conjunctival ophthalmia.* A syrup prepared from the fruit, or the jelly, forms an agreeable article, either alone or added to drinks, for patients laboring under *febrile diseases*, *diarrhœa*, *dysentery*, and *nausea.* The following preparation rubbed upon the parts twice daily, has been recommended to discuss slow *inflammatory deposits* and *tumors.* ℞ Quince seed ℥iv, alcohol fl℥viij. Macerate 20 days and express. Mix with an equal bulk of turpentine (Scudder, *Spec. Med.*, 122). The mucilage should always be freshly prepared, as it sours readily.

Related Species.—*Cydonia japonica*, Persoon (*Pyrus japonica*, Thunberg). *Japan quince.* This beautiful shrub, cultivated for ornamental effect, has handsome crimson or fire-red flowers, an acidulous fruit possessing a somewhat spicy fragrance, and smooth, shining, coriaceous, serrated, ovate-lanceolate leaves, acute at each extremity. Properties probably similar to those of the preceding plant. It is a native of Japan, and blooms in April and May.

CYNARA.—GARDEN ARTICHOKE.

The leaves of *Cynara Scolymus*, Linne (*Cynara Cardunculus*, var. *sativa*, Moris). *Nat. Ord.*—Compositæ.

Common Names: *Artichoke*, *Garden artichoke*.

Botanical Source.—This plant is perennial, with subspinose, pinnate, and undivided leaves. The heads are discoid and homogamous; the involucre dilated and imbricate; the scales ovate, with fleshy bases, emarginate and pointed; the receptacle setaceous; the pappus plumose and sessile; and the achenia not beaked (W.).

History.—This well-known plant is a native of southern or Mediterranean Europe, and is cultivated in this country. The flowers, or *heads*, as they are commonly called, appear in August and September, and are the parts used; the succulent receptacle and part of the calyx-leaflets are the edible portions. In their young state, the heads, prepared with vinegar, salt, etc., are much valued by some persons. The corollas are used for coagulating milk. The juice of the leaves is amarous. This plant must not be confounded with the *Helianthus tuberosus* or *Jerusalem artichoke*, a species of sunflower, the tuberous roots of which are sometimes used as a substitute for potatoes, and as feed for hogs.

Action, Medical Uses, and Dosage.—Diuretic and alterative. Reputed very beneficial in *dropsies*, and has been efficient in *rheumatism*, *gout*, *jaundice*, *tic-douloureux*, etc. The recent leaves only should be used in the form of an extract, or alcoholic solution. Dose of the tincture, 30 to 60 drops, repeated 3 times a day; of the extract, 3 to 6 grains (Dr. Badely, in *London Lancet*, 1843, p. 556).

Related Species.—*Cynara Cardunculus*, Linné; *Cardoon.* Native of Mediterranean Europe. Used as a food similarly to the above species. The Romans ate the flower receptacle under the name *girello*, as do also the Italians. It has been naturalized over a large extent of the Pampas of Buenos Ayres, and in Chili, and is now so plentiful as to be a hindrance to travellers (A. De Candolle, *Origin of Cultivated Plants*, 1882).

CYNOGLOSSUM.—HOUND'S TONGUE.

The leaves and root of *Cynoglossum officinale*, Linné.

Nat. Ord.—Boraginaceæ.

Common Name: *Hound's tongue.*

Botanical Source.—This is a biennial plant, with an erect, silky-pubescent stem, growing from 1 to 2 feet in height. The leaves are hoary, with soft down on both sides, lanceolate, acute, and entire—radical ones alternate at the base, petiolate; cauline ones sessile, clasping, with rounded or slightly heart-shaped bases. The flowers are in terminal, panicled clusters, recurved at the end; the calyx downy and 5-parted; the corolla reddish-purple, short, funnel-form, and vaulted; the throat or orifice closed by 5 converging, convex scales. Stamens shorter than the corolla. Achenia depressed, fixed laterally to the style; seeds rough, with hooked prickles (W.—G.).

History.—This plant is met with in Europe and this country, growing in waste grounds and road-sides; its name is derived from the peculiar form of the leaf; it bears purple flowers in June and July. The root is preferred to the leaves; it has a heavy, mouse-like, unpleasant odor, which is removed by desiccation, and a mawkish, amarous taste. The fresh plant is much more active than the dried.

Chemical Composition.—Prof. Schlagdenhauffen and E. Reeb, in 1892 (see *Amer. Jour. Pharm.*), found the constituents of roots, stems, leaves, and seeds of *Cynoglossum officinale* identical with those of *Heliotropium europæum.* The roots yielded by extraction with hot petroleum ether a red coloring matter identical with that from alkanna. An alkaloid, *cynoglossine*, was found to exist in the alcoholic extracts of the roots and the seeds of both plants, but not in the stems or the leaves. The authors could not establish for it any curarine-like physiological properties, as claimed by others.

Action, Medical Uses, and Dosage.—Anodyne, demulcent, and astringent, and has been used in *coughs*, *catarrhs*, *hemoptysis*, *diarrhœa*, and *dysentery*. Externally, in the form of a poultice, it has been found highly beneficial in *scrofulous tumors*, *burns*, *goitre*, and may be applied to recent *contusions* or *inflammations* with much advantage; also to remove the pain and soreness attending *irritated*, *bruised*, or *chafed parts*, giving complete and immediate relief, especially in *excoriation of the feet* from much traveling. The tincture, or the application of bruised fresh leaves will remove the swelling and *ecchymosis* consequent upon severe *blows* or *bruises*. Paralyzing effects are said to be produced by it in the vertebrate animals.

Related Species.—*Cynoglossum amplexicaule* or *Wild comfrey*, affords a root which may be substituted for the official comfrey.

Cynoglossum Morisoni, De Candolle, called *Virginia mouse-ear*, *Beggar's-lice*, and *Dysentery-weed*, has been variously classed by botanists, as *Rochelia virginiana*, *Myosotis virginica*, and *Echinospermum virginicum*. It is an annual plant, with an erect, hairy, furrowed, very broadly branched and leafy stem, from 2 to 4 feet in height. Leaves from 3 to 4 inches long, oblong-lanceolate, acuminate, entire, remote, tapering at the base, thin, minutely downy underneath, scabrous above, lower ones petioled. Branches slender and remote, each terminating in a centrifugal, divaricate, dichotomous, hairy, paniculate raceme, leafy-bracted at the base. Flowers very small, white or pale-blue; pedicels nodding in fruit. Fruit convex, densely covered with prickles having barbed points. This plant is common throughout the United States, growing in rocky grounds and among rubbish, flowering in July (W.). The whole plant has an unpleasant odor. The root is the part used, and imparts its virtues to water. It is mucilaginous, tonic, and astringent, and has been found very efficient in *diarrhœa* and *dysentery*. From its excellent effect in these diseases, it has acquired the popular name of *dysentery-root*. It has also been used with marked advantage in *cholera infantum*, *gastro-intestinal irritation of continued fever*, and as a mild tonic during convalescence from acute disease. As a diuretic, it has been useful in *cystitis*, *nephritis*, and other diseases of the urinary organs. The root may be chewed, or given in powder or infusion *ad libitum*. It will probably be found useful in other diseases, where such a combination of properties is indicated.

Echium vulgare, Linné; *Viper's bugloss*, *Blue-weed*.—Europe, naturalized in the United States, where, in the eastern and middle states, it is fast becoming a noxious weed, destroying the usefulness of whole fields, and requiring great labor for its eradication, from the fact that the plant must be uprooted, a very difficult task, as the root is often 3 or 4 feet in length, running straight down into the ground. It resembles a raw-hide whip, and is dark brown externally and whitish within. The plant has a whorl of radical leaves, from the center of which arise several stems curved like the forms of an umbrella (reversed), and covered with sharp spines that break off easily in the fingers. The flowers form long, terminal racemes, and are of a beautiful blue color marked with pink. The root, when properly burned, has been used as a fine-grade charcoal by artists. The plant is diuretic, besides possessing the pectoral properties of the above drug.

Anchusa officinalis, Linné; *Bugloss*, *Ox-tongue*.—This is a rough and hairy plant, bearing cymes of purple-blue flowers. Its root is white internally, and deep or blackish-brown externally, resembling in shape that of alkanna. The herb, as well as the root, has a mucilaginous taste, and both have emollient properties. A cold, or nearly cold, infusion provokes diuresis; a hot infusion provokes diaphoresis.

Pulmonaria officinalis, Linné; *Lungwort*.—This is a rough plant with a stem about 1 foot in height. Radical leaves ovate, cordate, scabrous; cauline ones ovate and sessile; flowers blue, in terminal clusters; calyx prismatic, 5-angled, 5-toothed, and as long as the tube of the corolla; corolla infundibuliform, with a cylindric tube, orifice hairy, in 5 lines alternating with the stamens; stigma emarginate; achenia roundish, obtuse, imperforate at base (W.). Lungwort is an herbaceous perennial, growing in Europe and this country, in northern latitudes. In Europe it is a rough-leaved plant, but in this country the whole plant is smooth. The leaves are much used in France in cough mixtures. (For uses, see next species).

Mertensia virginica, De Candolle, or *Virginian lungwort*, or *Cowslip*, is frequently employed in the United States; it is the *Pulmonaria virginica* of Linnæus, and the *Lithospermum pulchrum* of Lehman. It is a smooth, erect, and elegant plant, about 20 inches in height; radical leaves obtuse, obovate-elliptical, become from 5 to 6 inches long, and about two-thirds as wide, many-veined; cauline long-lanceolate, sessile. Flowers blue, in terminal clusters. Calyx 5-cleft, much shorter than the tube of the corolla, limb longer than the tube; corolla nearly an inch long, funnel-form, 4 times the length of the calyx, naked in the throat, and the much-spreading border slightly 5-lobed; stamens and style included; filaments slender. Disk bearing 2 glands as long as the ovaries. The stem and leaves are usually pellucid-punctate. This plant is found in alluvial banks, growing from western New York to Georgia and the western states, and flowering in May. Being a showy plant, it is frequently cultivated. The leaves of this plant are the parts used; they are without odor, and have a faint, astringent, somewhat viscid taste. Water extracts their properties (W.—G.). This and the preceding plant are demulcent and mucilaginous, and may be used in decoction whenever this class of agents is indicated. They have been much used in *bleeding from the lungs*, *bronchial* and *catarrhal affections*, and others disorders of the respiratory organs.

Borago officinalis, Linné; *Borage*.—Levant. Naturalized in Europe and the United States. It has a fleshy white root; the plant is hispid, and the flowers blue or reddish, and borne in terminal racemes. The plant is often cultivated in gardens, and is occasionally used for salad. When fresh the plant is saline to the taste, and has an odor faintly recalling that of the common cucumber. The whole plant has been used in medicine. Braconnot and Lampadius found the plant to contain mucilage, resin, and a large amount of salts of potassium and calcium. Potassium nitrate has been found to the extent of 3 per cent. This plant is used to some extent in France, where it is employed in *fevers* and *pulmonary complaints* attended by excessive secretions. Owing to potassium nitrate, it is diuretic, and its mucilaginous properties render it demulcent and emollient. A fomentation of the flowers is used for *inflammatory swellings*, and for internal use an infusion of it is prepared (1 to 2 drachms to water 1 pint).

CYPRIPEDIUM (U. S. P.)—CYPRIPEDIUM.

"The rhizome and roots of *Cypripedium pubescens*, Swartz, and of *Cypripedium parviflorum*, Salisbury"—(*U. S. P.*).

Nat. Ord.—Orchideæ.

Common Names: *Ladies'-slipper*, *Yellow ladies'-slipper*, *American valerian*, *Umbel*, *Nerve-root*, *Yellow moccasin-flower*, *Noah's ark*.

Illustration: Johnson's *Med. Bot. of N. A.*, Plate VIII (Cyp. pub.).

Botanical Source.—Cypripedium pubescens is an indigenous plant whose roots are perennial, fibrous, fleshy, undulated, or crooked, long, about a line in diameter, from which arise one or several round, leafy stems, growing from 12 to 18 inches high. The leaves are from 3 to 6 inches long, by 2 or 3 broad, sheathing, oblong-lanceolate, entire, veined, cauline, acuminate, pubescent, alternate, and generally the same number on each side. Its flowers are large, very showy, terminal, and solitary. Segments 4. Lobe of the style triangular-oblong, and obtuse; the sepals ovate, oblong, and acuminate; the petals long, linear, and contorted; the lip shorter than the other petals, compressed laterally, very convex, and gibbous above, pale-yellow, and from 1½ to 2 inches long (B.—R.—W.).

Cypripedium parviflorum has been considered a distinct species by some botanists, and as a mere variety by others. It differs from the above in having the lobe of the style acute, the leaves are broader, the flowers somewhat smaller, and the perianth more brownish-purple in color (W.).

History.—This plant is found in most parts of the United States, in rich woods and meadows, flowering in May and June; its flowers are scentless. There are several varieties of it, all of which possess similar virtues, and the roots of which are undoubtedly collected, sold, and indiscriminately used with the official article (see *Related Species*).

The rhizomes and fibrous roots of these plants are the parts used in medicine. They should be gathered in autumn, cleansed from dirt, and carefully dried in the shade. They have a peculiar, slightly bitter, and rather nauseous taste, and a somewhat unpleasant odor. Alcohol, or boiling water, takes up their virtues, which, however, are impaired by boiling.

Description.—"Of horizontal growth, bent, 10 Cm. (4 inches), or less, long; from 3 to 5 Mm. ($\frac{1}{10}$ to $\frac{1}{5}$ inch) thick; on the upper side beset with numerous circular, cup-shaped scars; closely covered below with simple, wiry roots, varying from 10 to 15 Cm. (4 to 6 inches) in length; brittle, dark-brown, or orange-brown; fracture short, white; odor peculiar, heavy; taste sweetish, bitter, and somewhat pungent"—(*U. S. P.*).

Chemical Composition.—Mr. H. C. Blair (1866) found the root of *Cypripedium pubescens* to contain a volatile oil, a volatile acid, tannin, gallic acid, two resins, gum, glucose, starch, and ligneous matter; and salts of calcium, potassium, and magnesium. A more recent quantitative analysis by E. S. Beshore (*Amer. Jour. Pharm.*, 1887, p. 395) confirms these results, except that the tannic principle is distinct from both tannic and gallic acids. Alkaloids were not present, except a weak basic substance obtained in distilling the drug with milk of lime.

Cypripedin, an impure active principle, oleoresin-like, and incorrectly named cypripedin, has been procured from the root by a process similar to that named for oleoresins of iris, xanthoxylum, etc. It may be given in doses of from ½ to 2 or even 3 grains, but is inferior to other preparations.

Action, Medical Uses, and Dosage.—Tonic, stimulant, diaphoretic, and antispasmodic. Its chief value is as a nerve stimulant in atonic cases, improving both the circulation and nutrition of the nerve centers (Scudder). It is not a powerful agent. This root is valuable in all cases of *nervous excitability* or *irritability* unconnected with organic lesions, allaying the irritability, lessening any accompanying pain, producing a more calm and cheerful condition of the body and mind, and consequently favoring mental tranquillity, or sleep. Hence it has been of service in *hysteria*, *chorea*, *nervous headache*, *wakefulness* and *prostration in low fevers*, *epilepsy*, from reflex irritation, and, indeed, in all cases of morbid irritability of the nervous system, from functional derangement or reflex irritation. It will be found very efficient in the *nervousness*, *hypochondria*, or *mental depression* accompanying certain forms of derangement of the digestive organs, which is more generally met with among females. Its action is greatly increased when combined with certain other agents, though this is not always necessary or advisable; thus, combined with *Eupatorium aromatica* and *Scutellaria lateriflora*, it has proved beneficial in *neuralgia*, *delirium*, and *hypochondria*. A soothing syrup for *nervous irritation of children* is recommended by Prof. Scudder (*Spec. Med.*): R Specific cypripedium, compound tincture lavender, aa fl℥ii; specific lobelia, fl℥j; simple syrup, fl℥iii. Mix. The alcoholic extract is a good form of administration.

The following preparation has been used in *sick* or *nervous headache*, not dependent on acid stomach: Take of Nepeta cataria, Scutellaria lateriflora, and Cypripedium pubescens in powder, of each, ½ ounce, pour on a pint of boiling water, and infuse for 15 or 20 minutes. Dose, 1 fluid ounce of the warm infusion, after which, ½ fluid ounce, every ½ hour, for 3 or 4 hours, or until the headache ceases. Used thus, during 3 or 4 attacks of headache, it is asserted to have invariably effected permanent cures of this distressing complaint. An infusion is said to be beneficial in the *pains of the joints* following *scarlet fever*. Although considered by many practitioners superior to valerian, yet it will be found inefficient in many instances where the European article will prove beneficial. Prof. D. T. MacDougal (*Amer. Jour. Pharm.*, 1896, p. 218), points out that the leaves and stems of *Cypripedium spectabile* and *C. pubescens* exert a poisonous influence upon the human skin, and that the source of this property resides in the glandular hairs with which the plant is covered. Dose of alcoholic extract, from 10 to 20 grains; tincture, from 1 to 3 fluid drachms; infusion, from 1 to 4 fluid ounces; of the powder, 1 drachm in warm water, repeated as required; specific cypripedium, 10 to 60 drops.

Specific Indications and Uses.—Insomnia, nervous irritability, neuralgia, and delirium, all from atony; menstrual irregularities, with despondency; tendency to dementia at climacteric; mental depression from sexual abuse.

Related Species.—The following species of Cypripedium possess properties analogous to those of the official drug:

Cypripedium spectabile, Willdenow; *Showy ladies'-slipper.*—Having crowded, ovate-lanceolate leaves, embracing each other; lobe of the style elliptic-cordate, obtuse; sepals broad-ovate, obtuse; lip longer than the petals, cleft before, white striped with purple, 2 inches long, 1½ inches broad; flowers very large, 2 or 3 on each plant, appearing in May and June. The whole plant pubescent (W.).

Cypripedium acaule, Aiton; *Low* or *Stemless ladies'-slipper.*—Having a bulbous root with numerous fleshy fibers; scape leafless, 1-flowered; leaves radical, in pairs, oblong, obtuse; lobe of the style round-rhomboid, acuminate, deflexed; lip longer than the lanceolate petals, cleft before, purple, or white, nearly 2 inches long, veiny; flowers solitary, terminal, with a single, lanceolate bract at the base, and appearing in May and June (W.—B.—R.).

Cypripedium candidum, Willdenow; *Small white*, or *White-flowered ladies'-slipper.*—Having a leafy stem, oblong-lanceolate leaves; lobe of the style lanceolate, somewhat obtuse; lip rather shorter than the lance-linear petals, white, about ¾ of an inch long; flowers terminal, solitary. The plant is slightly pubescent, seldom growing above a foot in height; the flowers appear in May and June (W.).

Cypripedium arietinum, Aiton, or *Ram's-head ladies'-slipper.*—Having a leafy stem; elliptical, striate-veined, sessile, amplexicaul leaves; lobe of the style orbicular, somewhat obtuse; lip as long as the petals, saccate, obconic before, red, and white-veined, hairy at the orifice, about ½ inch long; perianth greenish-brown. The flowers are mostly solitary with a leafy bract at base, and appear in May and June (W.—B.—R.).

Cypripedium spectabile and *Cypripedium acaule* are said to possess more narcotic properties than the others, especially when inhabiting dark swamps.

DAMIANA.—DAMIANA.

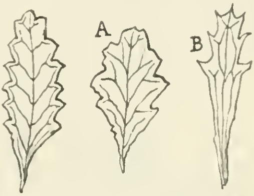
The leaves and top of *Turnera aphrodisiaca*, Ward and Vasey (*Turnera diffusa*, Willdenow, var. *aphrodisiaca*, Urban).

Nat. Ord.—Turneraceæ.

COMMON NAME: *Damiana.*

Botanical Source, History, and Description.—This drug was introduced, in 1874, by Dr. F. O. St. Clair, and first appeared in the form of fluid extract, from the firm of Messrs. Helmick & Co., of Washington, D. C. Three distinct varieties or species of plants under the name of Damiana, are occasionally found upon the market, and are derived from as many different sources. In connection with the history of this drug, it may be stated that Mr. H. S. Wellcome read a paper upon the subject before the New York Alumni Association of the Philadelphia College of Pharmacy, October 15, 1875, at the same time exhibiting cuts of leaves, which were known upon the market, at that time, as "Damiana," reproduced by us (Fig. 92).

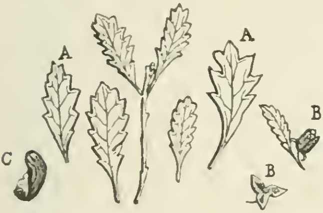
Fig. 92.



Mr. Wellcome's figures of Damiana (*Chicago Pharmacist*).

The true Damiana, the kind originally introduced by Dr. F. O. St. Clair, who obtained it from Mr. Eugene Gillespie, the United States Consul at Cape San Lucas, is derived from Mexico (see Fig. 93). It is evidently from a Mexican species of Turnera, supposed, by E. M. Holmes, to be a smooth-leaved variety of *T. microphylla*, De Candolle. Prof. Lester F. Ward, on the examination of authentic specimens obtained by Dr. St. Clair, concluded that the drug is obtained from an undescribed species of Turnera, which Prof. Vasey and himself designated *Turnera aphrodisiaca*, and this name we shall accept for the Mexican damiana, until further light is thrown upon the subject. The result of Prof. Ward's examination can be found in the *Virginia Med. Monthly*, April, 1876. We extend our thanks to Dr. St. Clair for the aid given us in our endeavor to obtain the complete history of this drug, as well as for the specimens of original damiana so kindly furnished by himself. In this connection we can say that the leaves of Fig. 93, marked A A, are drawn from the original lot of damiana imported by Dr. St. Clair, in 1872.

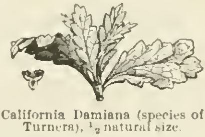
Fig. 93



Turnera aphrodisiaca (true Damiana). Natural size.

The genus Turnera is a small family of chiefly tropical American plants allied to the Passifloreæ. The flowers are small, yellow, and, in the species that produces damiana, subsessile near the end of the short branches. The calyx is tubular, hairy externally, colored like the petals, and 5-toothed at the apex. The petals are 5, yellow, and inserted on the tube of the calyx. The fruit, specimens of which are often found with damiana leaves, are dry, 1-celled, globular, and about the size of a large hemp seed (Fig. 93, B B). They are warty and rough externally, open by 3 valves, and contain from 3 to 6 kidney-shaped seeds (Fig. 93, C, magnified), attached to 3 parietal placentæ. Mexican damiana (*Turnera aphrodisiaca*), as found in market, consists of broken leaves mixed with fragments of the branches, and, sometimes, with seed-pods. The branches have a reddish-brown bark, and are covered, when young, with white, cottony hairs. The leaves (Fig. 93, natural size) are less than an inch long, obovate, wedge-shape, and taper at the base to a short, slender leaf-stalk; when young, they are covered with a slight pubesence, but become smooth

Fig. 94.



California Damiana (species of Turnera), $\frac{1}{2}$ natural size.

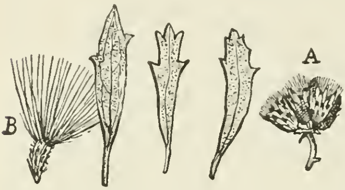
when old. They are distinctly pinnately veined, and the margin is toothed with from 8 to 10 teeth.

A variety of damiana, closely resembling the preceding, is derived from California. It was ascertained by Mr. E. M. Holmes to be obtained from *Turnera microphylla*, De Candolle, a small shrubby plant, native of lower California and northern Mexico. The leaves resemble the Mexican, but are broader, and covered with hairs on both sides (Fig. 92, A, preceding page).

A second kind of California damiana (also a species of Turnera) later made its appearance in the market. We are indebted to Mr. James G. Steele for the fact that this lot of damiana came from San Diego, California, and grew inland, at the southern part of the state. The leaves have the shape of the Mexican damiana, but are larger, and very hairy, especially underneath (Fig. 94, ½ natural size, preceding page).

The most common sophistication, however, once sold freely under the name of *Damiana*, is obtained from *Aplopappus discoideus*, De Candolle, a Compositæ plant of the section *Asteroideæ*. It is one of the few rayless species of *Aplopappus*, and is referred by some to the genus *Linosyris*. It has no botanical relation to the true damiana, and can only be considered a sophistication. The leaves (Fig. 95, natural size, and Wellcome's Fig. 92, B, preceding page) of this plant, as found on the market, are thick, firm, and not so much broken up as the Turnera; the surface of the leaf is rough, resinous, dotted, the mid-rib being prominent; but the veinlets are indistinct. The teeth are toward the apex of the leaf, and are rather remote and sharp. This plant can readily be distinguished from the true damiana by the presence of numerous flower-heads, which are common in all the specimens examined by us (Fig. 95, A). They are borne in axillary clusters of from 4 to 6 heads. The involucre is bell-shaped, and consists of numerous coriaceous imbricated scales, pubescent on the tips. The achenia (Fig. 95, B, magnified) are covered with a dense appressed pubescence, and bear a tawny, scabrous, spreading, unequal pappus.

Fig. 95.



Aplopappus discoideus (spurious damiana). Natural size

The sensible properties of the leaves of all the varieties (or species) of Turnera found upon the market, under the name damiana, are similar. All have a fragrant odor, resembling lemon-balm, and a pleasant, slightly aromatic taste. The leaves impart their virtues readily to hot water, as well as to mixtures of water and alcohol. The spurious damiana, *Aplopappus discoideus* (Fig. 95), is entirely different. It resembles more nearly the Grindelias, both in odor and taste. It is very resinous, and imparts its characteristic properties most freely to strong alcohol. Water hardly affects it, and mixtures of water and alcohol imperfectly exhaust the resinous principles, and do not permanently retain in solution such portions as are extracted. This spurious damiana need never be unintentionally employed, as both the general appearance of the leaf, and the sensible characteristics, are entirely different from all the species of Turnera. It has been offered at half the price of true damiana.

Chemical Composition.—When distilled with water, the distillate from the leaves yields an essential oil. This oil is lighter than water, possesses the characteristic odor, and imparts to the plant its fragrance. Chlorophyll, hard and soft resin, tannin, sugar, albuminoids, gum, and ash were found by Parsons in true damiana. Potassium chloride was found in spurious damiana by E. S. Wayne, in 1876. According to a more recent analysis of the leaves of damiana, by F. W. Pantzer (*Amer. Jour. Pharm.*, 1887, p. 69), alkaloids and glucosids were not observable. The yield of volatile oil obtained by distillation was 0.5 per cent.

Action, Medical Uses, and Dosage.—This drug has been almost eulogized for its positive aphrodisiac effects, acting energetically upon the genito-urinary organs of both sexes, removing *impotence* in the one, and *frigidity* in the other, whether due to abuses or age. Many physicians who have tried it, deny its possession of such virtues, but the friends of the drug attribute their failures to the use of the spurious articles. It will very likely be found to possess laxative, tonic, and diuretic properties only; and the aphrodisiac effects following its use, no more prove that these belong to it, than the same effects, that not unfrequently appear after the employment of many other agents, prove that such agents possess similiar excitant virtues. Upon the system at large, it exerts a tonic influence, and is useful in some cases of *chronic cystic* and *renal catarrh*. It relieves *irritation of the urinary mucous membranes*, improves digestion, and overcomes *constipation* in some instances. In *respiratory disorders*, it may be employed to relieve *irritation* and *cough*, and, by its tonic properties, to check *hypersecretion* from the broncho-pulmonic membranes. The dose of the fluid extract is from ½ fluid drachm to ½ fluid ounce; specific damiana, 5 to 60 drops.

Specific Indications and Uses.—To relieve irritation of the genito-urinary mucous surfaces. (Sexual weakness and debility, with nervousness and depression [?]).

Other Aphrodisiacs.—*Hygrophila spinosa*. India. Seeds reputed diuretic and aphrodisiac.

Muira-Puama.—A Brazilian wood containing an alkaloid, and reputed strongly aphrodisiac. Its botanical source is unknown (*Bull. of Pharm.*, 1892).

BURRA GOOKEROO.—The carpels and whole plant of *Tribulus lanuginosus* are said to be aphrodisiac and diuretic. A fluid extract of the fruit, in doses of 20 to 60 drops, is recommended for *nocturnal pollutions*.

Sphæranthus indicus, Mundi, Murmuria, Gorakhmundi, Kottakkarandai.—India. Contains a rich, cherry-red, volatile oil (Dymock). It is reputed deobstruent, alterative, tonic, and aphrodisiac.

DECOCTA.—DECOCTIONS.

The solution procured from the various parts of plants, by boiling them in water, is called a decoction. Decoctions are generally prepared from those articles which do not readily yield their active constituents to water, at a temperature below 100° C. (212° F.), yet it must be remembered, that as most plants contain starch, gum, and other inert matters, which are readily soluble in boiling water, these will generally be found associated with the remedial principles in a decoction. Medicines containing volatile principles, or substances liable to be changed into insoluble and inert matters at a boiling heat, should never be subjected to decoction. When, however, decoction is determined upon, the drugs should be sliced, bruised, or powdered, according to their character, and placed in an earthenware, glass, or iron vessel of suitable size, the latter being lined internally with enamel. In most instances, tin vessels may be employed, but copper, brass, iron, or zinc vessels, on account of their liability to oxidation, or incompatibility with such principles as tannic acid, are apt to prove injurious, and should not, therefore, be used. The water employed should be pure and clear, and the boiling should not be continued for too long a period. The vessel should be kept covered. The decoction should be strained before it cools.

In decoctions where several drugs are employed, each should be placed in the boiling water at periods adapted to the time required to obtain its soluble constituents. Some plants require to be boiled for some minutes, while others yield all their virtues if added toward the termination of the process. Volatile agents should be added after the decoction, which should be kept closely covered until cold, has been removed from the fire.

Decoctions are now seldom ordered from the pharmacist, but are made a matter of domestic management; hence, with but few exceptions, a list of decoctions is omitted herein, an explanation of the general rules relating to them being deemed sufficient. Physicians usually prepare decoctions by allowing 1 ounce of the drug to 1 pint of water, the dose depending on the activity of the agent, or the physiological effect required.

Decoctions are liable to speedy change or decompostion; consequently they should be made in small quantities. Decoctions have been largely superseded by the more stable and elegant pharmaceutical preparations of the present. Owing to the fact, however, that many are occasionally employed, we give formulæ for those most important. The *U. S. P.* gives the following general method for the preparation of decoctions:

"An ordinary decoction, the strength of which is not directed by the physician nor specified by the Pharmacopœia, shall be prepared by the following formula: Take of the substance, coarsely comminuted, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Put the substance into a suitable vessel provided with a cover, pour upon it one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of cold water, cover it well and boil for 15 minutes. Then let it cool to about 40°C. (104° F.), express, strain the expressed liquid, and pass enough cold water through the strainer to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Caution.—The strength of decoctions of energetic or powerful substances should be specially prescribed by the physician"—(*U. S. P.*).

The Pharmacopœia, of 1880, directed decoctions of 10 per cent drug strength. Those of the present *U. S. P.* have a strength of 5 per cent, and only two are recognized.

Decoctions Formerly Official.—The following decoctions were official in the *U. S. P.* of 1870: Decoctum Chimaphilæ, *Decoction of Pipsissewa*; Decoctum Cinchonæ Flavæ, *Decoction of Yellow Cinchona*; Decoctum Cinchonæ Rubræ, *Decoction of Red Cinchona*; Decoctum Cornus Floridæ, *Decoction of Dogwood*; Decoctum Dulcamaræ, *Decoction of Bittersweet*; Decoctum Hæmatoxyli, *Decoction of Logwood*; Decoctum Hordei, *Decoction of Barley*; Decoctum Quercus Albæ, *Decoction of White Oak Bark*; Decoctum Senegæ, *Decoction of Seneka*; Decoctum Uvæ Ursi, *Decoction of Uva Ursi.*

All were prepared (excepting decoction of barley) by boiling for 15 minutes a troy ounce of the drug in a pint of water, straining and finally bringing the finished product to 1 pint by adding to it a sufficient quantity of water.

DECOCTUM ALOES COMPOSITUM (N. F.)—COMPOUND DECOCTION OF ALOES.

Preparation.—*Formulary number*, 29: "Extract of aloes (*U. S. P.*), ten grammes (10 Gm.) [154 grs]; myrrh, seven and one-half grammes (7.5 Gm.) [115 grs.]; saffron, seven and one-half grammes (7.5 Gm.) [115 grs.]; potassium carbonate, five grammes (5 Gm.) [77 grs.]; extract of glycyrrhiza, in powder, thirty-five grammes (35 Gm.) [1 oz. av., 102 grs.]; compound tincture of cardamom (*U. S. P.*), two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Reduce the myrrh and extract of aloes to a coarse powder, mix this with the potassium carbonate and extract of liquorice in a suitable covered vessel, and pour on six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of water; boil for 5 minutes and add the saffron. When cool, add the compound tincture of cardamom, and allow the mixture to macerate for 2 hours; then filter through flannel and add enough water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. This preparation should be freshly made when wanted for use"—(*Nat. Form.*).

This decoction contains the same ingredients, and varies but little in proportions from that official in the *British Pharmacopœia.*

Action, Medical Uses, and Dosage.—Compound decoction of aloes is employed like compound tincture of aloes and myrrh, though the decoction is less stimulating. A gentle cathartic and emmenagogue for atonic states, as *constipation* and *amenorrhœa*. Dose, ½ to 2 fluid ounces.

DECOCTUM CETRARIÆ (U. S. P.)—DECOCTION OF CETRARIA.

Synonym. *Decoction of Iceland moss.*

Preparation.—"Cetraria, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Cover the cetraria in a suitable vessel, with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of cold water, express after half an hour, and throw the liquid away. Then boil the cetraria with one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of water for half an hour, strain, and add enough cold water, through the strainer, to make the product, when cold, measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

The object of macerating the moss in cold water is to remove a part of the bitter principle, a process objected to by many, who consider it no better than the ordinary demulcents, if it be deprived of this peculiar bitter. The *British Pharmacopœia* directs decoction of Iceland moss to be boiled 10 minutes.

Action, Medical Uses, and Dosage.—(See *Cetraria*). The dose is from 2 to 4 fluid ounces from 3 to 5 times a day.

DECOCTUM GRANATI RADICIS.—DECOCTION OF POMEGRANATE ROOT.

SYNONYM: *Decoctum corticis radicis granati.*

Preparation.—Boil 2 ounces (av.) of sliced pomegranate-root bark in 2 pints (Imp.) of distilled water, until reduced to 1 pint (Imp.). Strain, and if necessary, by pouring sufficient distilled water on the contents of the strainer, bring the finished decoction to measure 1 pint (Imp.). This accords with the *British Pharmacopœia*.

Action, Medical Uses, and Dosage.—Used internally to expel *tapeworms* (see *Granatum*). Also as a wash for *mucous*, *serous*, and *sanguineous fluxes*, and for *relaxed membranes* and *discharging ulcers*.

The following has been a standard with Eclectic physicians for many years: "Put 4 pints of water and 8 ounces of selected bark, into a kettle and boil well; then strain through muslin; press well. Add the contents of the strainer again to the same amount of water (4 pints), boil and strain as before. Mix the two liquids, and evaporate to the measure of 1 pint. Allow the decoction to cool before administering.

Directions for Use.—"The patient should fast 1 day, and on retiring should take 2 compound cathartic pills to loosen the bowels. Next morning on arising, take a good dose of Rochelle salts, and as soon as there is a profuse stool, take 2 or 3 ounces of decoction of pomegranate. If it be retained on the stomach, the worm will probably pass with the next stool. If the decoction is vomited, as is probable give another dose, after waiting a couple of hours for the stomach to rest."

DECOCTUM HÆMATOXYLI.—DECOCTION OF LOGWOOD.

Preparation.—Take 1 ounce (av.) of logwood (in chips), 55 grains of coarsely-powdered cinnamon bark, and 1 pint (Imp.) of distilled water. Boil the logwood in a closed vessel for 10 minutes, adding the cinnamon toward the end of the boiling period. Strain, and, by pouring sufficient distilled water upon the contents of the strainer, bring the decoction to measure 1 pint (Imp.).

The *British Pharmacopœia* directs the foregoing method which is improved by continuing the boiling longer in order to better exhaust the chips. A former *U. S. P.* process directed 1 ounce of logwood in 2 pints of water, to be reduced by boiling to 1 pint.

Action, Medical Uses, and Dosage.—(See *Hæmatoxylon.*) A mild astringent. Dose, from 1 to 2 fluid drachms (children), to 2 fluid ounces (adults)

DECOCTUM HORDEI.—DECOCTION OF BARLEY.

SYNONYM: *Barley water.*

Preparation.—Wash 2 ounces (av.) of pearl barley in cold water and throw away the washings. Then boil the barley in a closed vessel for 20 minutes, in 1½ pints (Imp.) of distilled water, and strain. This accords with the *British Pharmacopœia.* Boiling the barley for 1 or 2 minutes will remove mustiness or other unpleasant extraneous matter, if present, better than washing in cold water.

Action, Medical Uses, and Dosage.—An admirable unirritating, nutritious, and readily digestible drink for *fevers* or *irritable states of the gastro-intestinal* and *urino-genital tracts.* May be sweetened or acidulated when not contraindicated. Dose, 1 to 4 or more fluid ounces.

DECOCTUM PAPAVERIS.—DECOCTION OF POPPIES.

Preparation.—Boil, in a closed vessel, for 10 minutes, 2 ounces (av.) of bruised poppy capsules in 1½ pints (Imp.) of distilled water. Strain, and, by pouring sufficient distilled water on the contents of the strainer, bring the measure of the decoction to 1 pint (Imp.). This is official in the *Br. Pharm.* The seeds should not be rejected, as they add to the emolliency of the preparation.

Action and Medical Uses.—This is a feebly anodyne, emollient, and mucilaginous preparation, used locally as a fomentation to *inflammatory parts.*

DECOCTUM SARSÆ.—DECOCTION OF SARSAPARILLA.

SYNONYM: *Decoctum sarsaparillæ.*

Preparation.—Digest for 1 hour 2½ ounces (av.) of transversely cut Jamaica sarsaparilla in 1½ pints (Imp.) of distilled water. Then, in a closed vessel boil for 10 minutes. Cool, strain, and by the addition of distilled water, if necessary, bring the finished product to the measure of 1 pint (Imp.) This accords with the *British Pharmacopœia.*

Action, Medical Uses, and Dosage.—Many prefer to use the bruised root, and to avoid boiling, for the longer the preparation is boiled the weaker it becomes. An infusion is preferable to the decoction. Digestion of the root at a temperature of about 80° C. (176° F.) is probably the best method. This decoction is but little employed. Its uses are those of sarsaparilla. Dose, 2 to 4 fluid ounces 4 times a day.

DECOCTUM SARSAPARILLÆ COMPOSITUM (U. S. P.)—COMPOUND DECOCTION OF SARSPARILLA

Preparation.—"Sarsaparilla, cut and bruised, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; sassafras, in No. 20 powder, twenty grammes (20 Gm.) [309 grs.]; guaiacum wood, rasped, twenty grammes (20 Gm.) [309 grs.]; glycyrrhiza, bruised, twenty grammes (20 Gm.) [309 grs.]; mezereum, cut and bruised, ten grammes (10 Gm.) [154 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Boil the sarsaparilla and guaiacum wood for half an hour in a suitable vessel with one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of water. Then add the sassafras, glycyrrhiza, and mezereum, cover the vessel well, and macerate for 2 hours. Finally strain, and add enough cold water, through the strainer, to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This decoction may be given in *syphilitic* and *scrofulous conditions* as an alterative and mild diaphoretic. It is likewise employed in certain *cutaneous, rheumatic,* and other affections dependent on *blood dyscrasia.* Mezereum and sarsaparilla are its chief active agents. It is patterned after the *Decoctum lusitanicum,* or *Lisbon diet drink.* Somewhat similar preparations are employed in Germany under the names *Decoctum Zittmanni fortius,* and *Decoctum Zitmanni mitius,* or *Zittmann's stronger* and *milder decoctions,* which contain, however, cinnabar and calomel. The compound decoction of sarsaparilla may be given in doses of 3 to 6 fluid ounces, 3 times a day.

DECOCTUM SCOPARII.—DECOCTION OF BROOM.

Preparation.—The *British Pharmacopœia* directs the preparation of decoction of broom essentially as follows: Boil in a covered vessel 1 ounce (av.) of broom tops in a pint (Imp.) of distilled water for 10 minutes. Strain and pour upon the residue in the strainer sufficient distilled water to produce a pint (Imp.) of the finished product.

Action, Medical Uses, and Dosage.—This is actively diuretic, and is useful in *dropsical disorders*. Care must be taken in its administration, as it may provoke renal and cystic irritation. The dose is about 2 fluid ounces, given so that from ½ to 1 pint is taken in 24 hours.

Related Preparation.—DECOCTUM SCOPARII COMPOSITUM. *Compound decoction of broom.* Take of broom-tops, juniper berries, and dandelion root, of each, ½ troy ounce; water, Ojss. Boil down to 1 pint. Dose, from 1 to 2 fluid ounces.

DECOCTUM TARAXACI.—DECOCTION OF DANDELION.

Preparation.—Slice and bruise 1 ounce (av.) of dried dandelion root, and boil it in 1 pint (Imp.) of distilled water for 10 minutes; strain, and pour upon the residue in the strainer enough distilled water to make the finished product measure 1 pint (Imp.). This is in accordance with the *British Pharmacopœia*. A little orange peel added at the end of the boiling period, is said to increase its usefulness. It does not keep well and must be freshly prepared.

Action, Medical Uses, and Dosage.—(See *Taraxacum*.) This may be employed as a vehicle for the simple bitters. The dose is about 2 fluid ounces before meals.

DECOCTUM ULMI.—DECOCTION OF ELM-BARK.

Preparation.—Take 2½ ounces (av.) of small pieces of elm-bark and boil in 1 pint of distilled water, for 10 minutes, in a suitable covered vessel; strain, and pour upon the residue in the strainer sufficient distilled water to make the finished decoction measure 1 pint. This is in accordance with the *British Pharmacopœia*, of 1867.

Action, Medical Uses, and Dosage.—A mucilaginous, astringent, and bitter decoction. (For uses see *Ulmus*). Dose, from 2 to 4 fluid ounces. Mucilage of slippery elm is preferable.

DIERVILLA.—BUSH HONEYSUCKLE.

The root, leaves, and twigs of *Diervilla trifida*, Mœnch (*Diervilla canadensis*, Mühlenberg).

Nat. Ord.—Caprifoliaceæ.

COMMON NAMES: *Bush honeysuckle*, *Gravelweed*.

Botanical Source.—This plant is a low shrub, with a branching, pithy stem, about 2 or 3 feet high. The leaves are from 2 to 4 inches long by 1 to 1½ broad, ovate, acuminate, finely serrate, opposite, deciduous, and borne on short petioles. The peduncles are axillary and terminal, dichotomous, and from 1 to 3-flowered. The flowers are greenish-yellow. Calyx tube oblong, limb 5-cleft, with 2 bracts; corolla twice as long as the calyx, greenish-yellow, 5-cleft, funnel-shaped; border 5-cleft, spreading. Stamens 5, which, with the style, are much exserted; stigma capitate. Capsule oblong, attenuate above, 2-celled, and naked, with many seeds (W.).

History.—This is a woody shrub, growing in the United States from Canada to Carolina, in hedges and thickets, and by the sides of fences and rocks, flowering in June. The leaves, twigs, and roots are the parts used, and they yield their properties to alcohol, and boiling water in infusion.

Action, Medical Uses, and Dosage.—Diuretic, astringent, and alterative. A cold infusion of the bruised leaves and twigs, used freely, has been very beneficial in *inflammation of the bladder*, with gravelly deposit in the urine, in *nephritic* and *calculous affections*, and in *gonorrhœa*. The root, in decoction or syrup, has been lauded for the cure of *syphilis*. Externally applied in *erysipelas*, or *erysipelatous inflammations*, and over the *inflamed surface* occasioned by the rhus, ivy, or poison vine, it soon relieves the itching, burning, inflammation, and swelling.

DIGITALIS (U S. P.)—DIGITALIS.

"The leaves of *Digitalis purpurea*, Linné, collected from plants of the second year's growth"—(*U. S. P.*). (*Digitalis tomentosa*, Link et Hoffmann).

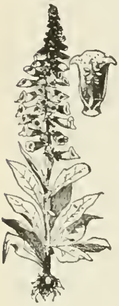
Nat. Ord.—Scrophularineæ.

Common Names: *Foxglove, Purple foxglove.*

Illustrations: Bentley and Trimen, *Med. Plants*, 195; Woodville, *Med. Bot.*, Plate 24.

Botanical Source.—Foxglove is a handsome biennial plant, with a whitish root of numerous long and slender fibers. The stem is straight, wand-like, leafy, mostly simple, roundish, with several slight angles, downy, and 3 or 4 feet high. The leaves are alternate, ovate, or elliptic oblong, crenate, downy, rugged, and veiny, of a dull-green, tapering at the base into winged footstalks, the radical ones being largest. The flowers are numerous, large, pendulous, scentless, purplish-crimson, elegantly marked with eye-like spots, and hairy within, and are borne in terminal, 1-sided, erect, simple racemes. The corolla is monopetalous, campanulate, ventricose, contracted at the base, with an oblique limb; upper lip emarginate, lower trifid, with the middle lobe the largest. The calyx is composed of 5 acute sepals, permanent, and much shorter than the corolla; the uppermost are narrowest. The stamens are didynamous, and inserted into the base of the corolla; anthers large, acute, naked; style simple; stigma bilamellate. The capsule is ovate, sharp-pointed, with a septicidal dehiscence; seeds many, small, grayish-brown, pitted, and oblong (L).

Fig. 96



Digitalis purpurea.

History.—Foxglove is indigenous to the larger portion of Europe, and has been introduced into the United States, where it flowers in June and July. It grows in thickets, along woodland borders, and on the commons, preferring a sand-soil, not being often found where limestone abounds. Though also a mountain plant in the warmer portions of Europe, it is not found in the Swiss Alps and Jura Mountains (*Pharmacographia*). It has been naturalized in the Isle Chiloe of South Chili (Cunningham). The official part is the leaves, though the seeds will also be found efficient. The leaves should be collected from the second year's growth, while the plant is in bloom—Duncan says "before the inflorescence"—selecting only those which are fully developed, and separating from them the inert petioles and mid-veins; they should then be dried by exposure to a current of dry air, by being placed in a drying stove, or by being inclosed in a hot air press. Much care is necessary in preserving them for medicinal purposes. When well prepared the powder has a fine green color, and retains the intense bitterness of the fresh leaves. The leaves, when dried or in powder, should be placed in opaque, well-closed vessels, to protect them from the deleterious influence of dampness and light; and the drug should be renewed annually, as it loses its virtues by age. The seeds, though but little used, retain their properties much better than the leaves. Fresh foxglove leaves have a slight virose odor, which, by desiccation becomes feebly narcotic, with an acrid, bitter, disagreeable taste and a dark-green color. Their properties are yielded to alcohol, ether, water, or diluted acids.

Description.—The *U. S. P.* describes digitalis leaves as follows: "From 10 to 30 Cm. (4 to 12 inches) long; ovate or ovate-oblong; narrowed into a petiole; crenate; dull green, densely and finely pubescent; wrinkled above; paler and reticulate beneath; midrib near the base broad; odor slight, somewhat tea-like; taste bitter, nauseous. An infusion prepared with 1 part of digitalis and 10 parts of boiling water, and allowed to cool, has a peculiar odor, turns blue litmus paper red, and, upon the addition of a few drops of ferric chloride T.S., acquires a darker tint, a brown precipitate appearing after a few hours. The infusion, diluted with 3 parts of water, becomes turbid on the addition of a few drops of tannic acid T.S."—(*U. S. P.*).

Chemical Composition.—Digitalis purpurea was first investigated chemically by Destouches, in 1809, although the plant has been known in botanical literature through the writings of Leonhard Fuchs since 1542. Dulong d'Astafort

(1827) appears to have been the first to recognize the bitter substance, digitalin, "as an individual body, capable of forming an insoluble compound with infusion of galls (*Archiv. der Pharm.*, 1870, p. 28). This reaction was employed by later observers in the making of digitalin, *e. g.*, by Homolle and Quevenne. In 1844, the Société de Pharmacie of Paris awarded a prize to these chemists for having succeeded in isolating the active principle of digitalis; yet their digitalin, though crystalline and no doubt purer than similar preparations of their predecessors, was by no means a uniform substance. Neither were the preparations obtained by later chemists, *e. g.*, Walz (1846–58), and Kosman (1861 and later), individual substances. Nativelle (1867–74) prepared *digitaline cristallisée*, which at last was believed to be pure. Meanwhile a commercial distinction had been established between *German* digitalin (originating from Walz's preparation), an amorphous powder easily soluble in water and alcohol, less soluble in chloroform, and very little soluble in ether; and *French* crystalline digitalin (that of Homolle and Quevenne, and Nativelle), easily soluble in chloroform and alcohol, but hardly soluble in water and ether. In this connection it may be stated that the *French Codex* gives detailed directions for the preparation of both *digitaline amorphe* and *digitaline cristallisée*, the yield of the latter being 1 gram from each kilogram of leaves. To Schmiedeberg (1874) we are indebted for a critical study of the more important digitalins of commerce. He arrived at the conclusion that these preparations were composed mainly of the following principles: *Digitonin*, *digitoxin*, *digitalin*, and *digitalein*. The first is an inactive glucosid, while the three others have the property of acting upon the heart, *digitoxin* possessing this power in a most pronounced degree. The more recent researches of Kiliani have materially extended our knowledge of the chemical nature of these substances.

Digitonin.—This medicinally inert substance was obtained amorphous by Schmiedeberg. Kiliani found that it will easily crystallize from 85 per cent alcohol, and that by means of this solvent it may be abstracted from water-soluble commercial digitalin. When crystallized, digitonin is less soluble in water than when amorphous; its solution foams when shaken. It is little soluble in alcohol, insoluble in ether, chloroform, and benzin, and forms an insoluble tannate. Warmed with diluted hydrochloric acid, it splits into *digitogenin* (observed by Schmiedeberg), galactose, and dextrose (Kiliani, *Ber. d. d. Chem. Ges.*, 1890).

Digitoxin.—This forms the main constituent of Nativelle's digitalin. It is insoluble in water, although the presence of other digitalis glucosids or extractive matters may render it more soluble. It dissolves freely in alcohol and chloroform, slightly in ether, but is insoluble in petroleum ether (Keller, 1897). It yields a precipitate with tannic acid, but not with basic acetate of lead. Schmiedeberg could not establish the presence of sugar as a constituent of digitoxin, although he obtained *toxiresin* by the action of acids. Recently Kiliani succeeded in resolving digitoxin ($C_{31}H_{50}O_{10}$), into *digitoxigenin* and a substance, *digitoxose* ($C_9H_{15}O_6$), resembling sugar (*Archiv. der Pharm.*, 1896, p. 481).

Digitalein.—The existence of this substance as an individual body is questioned by such authorities as Kiliani and C. C. Keller (*Ber. d. d. Pharm. Ges.*, 1897, p. 125), who pronounce it to be most likely a mixture of digitonin with traces of digitoxin and digitalin.

Digitalin.—Schmiedeberg proved this to be a glucosid, but, excepting a resinous substance which he called *digitaliresin*, was unable to obtain a well defined product of hydrolysis. Homolle and Quevenne's digitalin he pronounced to be composed mainly of digitalin and digitaliresin. He also found that digitalin acts on the heart, but in a much milder form than *digitoxin*. It is soluble in water.

Kiliani, considering digitalin a useful therapeutic agent, made it a commercial product under the name *digitalinum verum*, believing it to be a uniform substance, notwithstanding its refusal to crystallize. He finally succeeded in resolving it into *digitaligenin*, a well-defined crystalline body, dextrose, and *digitalose* (*Archiv. der Pharm.*, 1892, p. 250; also see *Pharm. Jour. Trans.*, 1895, p. 29, for details of preparation of *digitalinum verum*). As regards the therapeutic use of *digitalin*, there has been a tendency in late years to give preference to *digitoxin* and the preparations containing it, although it was formerly discarded on account of its insolubility in water, as well as the violent action it exerts when in solution. (See *Amer. Jour. Pharm.*, 1897, p. 450, for Keller's process of preparation). Keller's test for digitoxin is as follows: Dissolve digitoxin in glacial acetic acid containing ferric chloride; float this solution upon strong sulphuric acid. At the line of contact a dark zone appears, and after a few minutes the acetic acid liquor becomes dark blue. This reaction takes place with $\frac{1}{10}$ of a milligramme of digitoxin in 1 Cc. of acetic acid. As to the occurrence of the digitalis glucosids in leaves and seeds, Keller holds (1897) that digitoxin, digitonin, and digitalin in different proportions may be obtained from both sources. The amount of digitoxin in the leaves was observed by him to vary from 0.26 to 0.62 per cent. Kiliani, on the other hand, remarks (*Pharm. Jour. Trans.*, 1895, p. 120, and 1896, p. 289), that digitalis seeds contained digitonin and digitogenin, and are besides the (more remote) source of his digitalinum verum, which does not occur in the leaves. The latter contain principally digitoxin, which is not to be found in the seeds. The relation of Arnaud's *digitaline cristallisée* (see *Jour. Pharm. Chim.*, 1889, pp. 454 and 514) to the aforenamed principles remains yet to be established.

Other Constituents of Digitalis.—Morin (1845) isolated an acid substance which he called *digitalic acid*, which Flückiger believed to have been malic acid merely; and volatile *antirrhinic acid* which resembles valerianic acid. *Digitalosmin* was an odoriferous substance having a nauseous taste, obtained by Walz in 1852. The sugar *inosit*, was discovered in the leaves by Marmé, in 1864. The ash in the leaves was found by Flückiger to be 10.56 per cent. Infusions of digitalis sometimes gelatinize, owing to the precipitation of modified pectin matter, the result of the influence of micro-organisms. This change is facilitated (Dr. Forcke, *Amer. Jour. Pharm.*, 1890), by the employment of the petioles in making the infusion, as they are richer in pectin matter than the leaf itself. The *U. S. P.*, and other pharmacopœias as well, direct that leaves of the second year's growth be employed, as the infusion from leaves collected in the first year are believed to be prone to gelatinize.

Action and Toxicology.—In single large doses, digitalis is an irritant-narcotic poison, producing gastro-intestinal irritation, nausea, vomiting, and very abundant alvine evacuations. Its action is afterward spent upon the nervous system, causing vertigo, dimness of sight, delirium, convulsions, or a general debility, and finally death (E. & V.). A slow, feeble, irregular pulse and suppression of urine are generally present. When given in medicinal doses, too long continued, or in quantities to exert an immediate action on the system, it causes an increased discharge of urine, reduces the pulse from 70 beats in a minute to 30, with languor, nausea, occasionally anxiety and salivation, a sense of weight, or constriction, obtuse pain in the head, giddiness, disordered vision, mental disturbance, and rarely spectral illusions; not unfrequently a huskiness of the voice is present, the result of irritation of the fauces, trachea, etc. The nausea produced by digitalis, and more quickly by digitalin and digitoxin, is preceded by malaise, faintness, and depression, and is exceedingly distressing. Vomiting temporarily relieves it, the vomited material being first dark-green, afterward yellow. Prostration becomes so great that the individual can not stand without help, and an intense disgust for food is experienced. Familiar objects are unrecognizable—a disturbed vision with yellowness or blueness supervening. Persons are recognized only by their voices. These effects, if not fatal, may last several days, the sleep being disturbed by nightmare and general unrest. Finally sound sleep and a voracious appetite quickly restore the individual to normal health. If the use of the remedy be persisted in, these effects will continue to increase until the poisonous symptoms, first referred to, become developed. Dr. Fuller states that digitalis stimulates the muscular fibers of the heart, and augments the contractility of the capillaries; when it kills it does so not by producing paralysis of the heart, but by giving rise to tonic contraction and spasm of that organ.

Primarily, digitalis acts upon the heart as a stimulant, increasing the tension and pulse rate; larger doses, acting as a sedative, reduce the pulse, but the tension remains unaffected. The diastole is prolonged while the systole is increased in vigor. A lethal dose produces a tetanic contraction of the heart muscle, particularly of the left ventricle, the heart being arrested in systole. The effect of the stronger systole and the prolonged diastole is a reduction of the number of pulsations. Not only does a contraction of the heart muscle take place, but a marked contraction of the arterioles also results, so that the blood current is reduced in size and the amount of blood sent through the arteries to the different parts of the system is decreased. A rise of blood pressure then ensues from the resistance of the narrowed arterial calibre and increased systolic action. From the fact that, after the administration of full medicinal doses, a change of posture, as from the recumbent to upright position, occasions a greatly increased number of pulsations and a marked diminution of cardiac force, it has been assumed that no real power is imparted to the heart by digitalis. This has been explained by others as an occurrence only met with when the tonic action is about to verge into that of exhaustion from overstimulation. Lethal doses cause the tetanic contraction above mentioned, obstructing the passage of blood through the organ and death takes place from spasm, resulting in syncope. In woman, digitalis, like ergot, causes contraction of the uterine fibers of an enlarged or gravid uterus, thereby arresting hemorrhage; in man it primarily lessens the supply of blood to the erectile tissues of the penis, preventing or enfeebling erections and consequently diminishing the venereal desires.

Many affirm that digitalis has no direct diuretic power. In health it is known to generally lessen the secretion of both the solid and fluid constituents of the urine. Some contend that it slightly increases the flow of urine. It is more than probable that, when diuresis is the result of its administration, it is in those cases in which a diminished secretion of urine is due to debility or some other form of cardiac embarrassment. Others, however, maintain different views, and Brunton asserts that diuresis produced by it in dropsy is due to a special action of the drug upon the Malpighian bodies, and not to augmented blood pressure alone.

Poisoning by digitalis may be produced by $\frac{1}{16}$ grain of digitalin (equal to 8 grains of good powdered digitalis leaves), and Taylor (*Med. Juris.*, p. 229) states that doses of from $\frac{1}{4}$ to $\frac{1}{2}$ grain would probably produce death. Cold, belladonna, ergot, etc., increase the activity of digitalis, while aconite opposes its action. According to Bartholow, the most complete antagonist to digitalis, physiologically speaking, is saponin. Strychnine is also a physiological antagonist.

The poisonous effects of digitalis are best counteracted by first evacuating the stomach by the free use of warm liquids and mechanical emetics, if any of it is supposed to remain in the stomach, and then administering brandy, wine, opium, black coffee, ammonia, ammonium carbonate, or other stimulants, with sinapisms to the wrists and ankles. Both external and internal heat should be used. A solution of tannic acid might be of service, by forming an insoluble tannate of digitalin. Preparations containing tannin, such as tea, etc., may be given. Iron sulphate and chloride are recommended by some as chemical antagonists. Digitalin produces similar effects on the system with digitalis, but its internal administration is hazardous, and demands much care and prudence. After death from digitalis the gastric membranes were found partially inflamed and the meninges of the brain much injected (Taylor).

Action, Medical Uses, and Dosage.—In medicinal doses, foxglove is sedative and secondarily diuretic. It has been employed with asserted advantage in *febrile diseases*, *acute inflammations*, *insanity*, *neuralgia* attended with *irritative fever*, *asthma*, *hemoptysis*, *whooping-cough*, *palpitation of the heart*, *epilepsy*, and as a diuretic in *dropsy*, connected with diseased heart or kidneys. As a sedative in *fevers* and *inflammations*, its use is not to be commended, in view of the fact that it tends to produce unpleasant gastric disturbances and other disquieting symptoms. It has been claimed that it is of great service in *scarlatina*, both for the purpose of producing sedation and keeping the kidneys active, thus tending to avert *post-scarlatinal dropsy* and *uræmia*. That it will do this without some heart debility being present also, is by no means well established, while, on the contrary, its unpleasant, nausea-provoking properties make it an undesirable remedy. The same is true of it in *typhoid* and other *febrile disorders*. It should always be used with care, on account of its *cumulative effect*, which may otherwise occasion an unexpected fatality. Such cumulative action is not, however, likely to occur unless the dose be too large and too frequently repeated, thus overlapping the successive doses when, like any other remedy so administered, its effects will become cumulative. The old view of cumulative effects from small doses suddenly developing toxic symptoms, is not now held by many, yet it is proper to be cautious and to keep within the bounds of safety. When its constitutional effects become obvious, the exhibition of the remedy should be omitted from time to time, in order to guard against the results of this alarming accumulation. When its sedative effect is too great, it is best counteracted by the use of wine and opium conjointly.

Like ergot, by its contractile power over the capillaries, digitalis is a remedy for *asthenic hemorrhage*, *metrorrhagia*, *menorrhagia*, *purpura hemorrhagica*, *epistaxis*, and *hemoptysis*, though it is of less value in the last-named disorder than in those of uterine origin. However, as a remedy for hemorrhage it will not take an important place when other drugs are so preëminently superior for this purpose. Digitalis has not found favor with the majority of practitioners of our faith in *pulmonic* and *bronchial inflammations* (except *pulmonary congestion*), as it has with some of the members of the Allopathic persuasion. No materia medica is so rich in efficient broncho-pulmonary remedies as the Eclectic, and, as digitalis is too uncertain in its effects in these disorders, and so liable to occasion intestinal disturbances, it is not likely to become at all important with us in this branch of therapy. In *nervous disorders* it has a limited usefulness. In *chronic mania*, *acute maniacal delirium*, and in *delirium tremens* it has been administered with asserted success, but as the indications for its selection, given by different observers, are diametrically opposed, it is difficult to make a selection of the proper cases. It is probable, however, that it is of some value in *congestive hemicrania*. *Functional exophthalmic goitre*, in the anemic young, and associated with cardiac weakness and dilated vessels, is often benefited by digitalis combined with restoratives.

It is in *heart troubles of an asthenic character*, however, that digitalis shows its power as a true remedy. As a general statement it may be said that it is indicated by a weak, rapid, and irregular heart and low arterial tension—a condition of asthenia; and it is contraindicated by a strong, vigorous heart action, with high arterial tension—a sthenic state. As Prof. Locke very properly states, "digitalis is the true opium for the heart."

Digitalis primarily excites the vaso-motor nerves only, those which are limited to the ventricular portion of the heart, contracting the blood vessels and heart muscle; temporarily quickens the heart's action, and secondarily, through paralysis of those nerves, dilatation of the blood vessels ensues with consequent spasm of the muscular tissues. Hence in *cardiac hypertrophy*, when simply compensatory, it should not be given at all; in *cardiac dilatation* it should be given in doses to produce its physiological action. Digitalis acts as a sedative to an *over-excited* and *irregular heart*, and as a tonic to a *weak* and *enfeebled heart*. But its principal employment should be in dilated enfeebled heart with feeble and irregular pulse. According to some writers it is contraindicated in ramollissement and fatty degeneration of the heart, and in aortic regurgitation, while it is especially beneficial in *aortic obstructive disease*.

That the slowing of the heart, with more powerful contractions and greater resistance to the blood current in the contracted arterioles produced by it, would render the drug inadmissible in a heart already enfeebled by fatty depositions, must be self-evident. *Slight muscular degeneration* is said not to contraindicate it, providing there are otherwise strong reasons for its use. But when *aortic regurgitation* occurs, which is due to faulty action of the valves (*valvular insufficiency*), the heart is but relatively weak, and a stronger contraction is needed to force the current onward, and thus prevent, as far as possible, the valvular leakage. Of course, some hypertrophy exists here, but not enough to be compensatory. Given to physiological effects, in *aortic stenosis*, it may produce death. M. Legroux states that, when given to persons in feeble health, it increases the contractile power of the capillaries, causing increased arterial tension, lowering the temperature of the body, diminishing the frequency of the heart beats, and relieving *local congestions*. It has, in this manner as before stated, been of service in *pulmonic congestion*, *uterine* and *pulmonary hemorrhage*, and in *hemorrhoids*. In cases where the circulation is generally active, with small, frequent, but regular pulse, aconite is preferable to digitalis. "Digitalis is indicated where there is a diminution of vascular tension; if the cardiac palpitations are purely nervous without any modification of arterial tension, digitalis is of no value. Another indication for the use of digitalis is *œdema*, which shows an abnormal disposition of the cellules to admit the fluid material of the blood into them. It should not be employed in heart diseases of aged persons, among those heart diseases that have already attained to a period of complete and continued asystole, nor in excessive dilatation of the heart, various cardiac degenerations, and other persistent conditions of a manifest (extreme) hyposthenia" (Ferrand).

To sum up, digitalis is useful in the following conditions: In *structural heart lesions*, as *dilated heart with mitral incompetence;* in *mitral stenosis* and *regurgitation*, and *in dilated right heart with tricuspid incompetence*, and in relative or positive *debility of the cardiac muscle*. The mechanical trouble is a state of *ischæmia*, or lack of sufficient arterial blood in the left heart, while in the right heart and the entire systemic and pulmonic circulation there is venous stasis. Digitalis increases the power of the auricles and ventricles to empty themselves; prolongs the inter-contractile intervals, thus allowing the auricles sufficient time to more perfectly send the blood current into the ventricles. It restores and regulates a mechanical compensation or balance in the circulatory organs. The general symptoms leading to its selection are a weak, rapid, and irregular pulse, low arterial tension, cough, dyspnœa, pulsation of the jugular veins, a cyanotic countenance, deficient urination, the secretion being high-colored, and œdema.

Digitalis is contraindicated in simple compensatory hypertrophy, aortic stenosis, fatty or other degenerations of the heart muscle, and atheromatous or other structural changes in the arteries. As a rule it should not be employed in the heart affections of old age, or when dilatation is excessive, and particularly when the flabby state of the heart muscle is due to degenerative changes.

It was formerly believed and still the view is held by many, that the diuretic effect of digitalis is the result of its secondary action. If, however, the views more recently advanced, that it has also a special action upon the renal glomeruli be true, the reason for its well-earned reputation as a remedy in *dropsy* will be be more apparent. Digitalis has long been known as an efficient remedy where the dropsical condition was dependent upon cardiac irregularities and upon renal congestion. When the trouble is cardiac in origin it relieves by strengthening the heart action and producing capillary contraction. When of renal origin, obstructing the circulation, it relieves at least the tension of the renal capillaries, thus lessening engorgement and bringing about absorption and diuresis. In general dropsy it is indicated by the distressing dyspnœa, especially when in the recumbent posture, fullness and pulsation of the jugulars, pale or dusky countenance, scanty and high-colored urine, and quick, feeble, fluttering, and irregular pulse. When known to be associated with the cardiac lesions in which digitalis is indicated, it seldom fails to remove the dropsical effusion. It relieves *chronic nephritis* by lessening vascular tension in the renal capillaries, and in *granular degeneration of the kidneys* it is said to benefit by lessening the proportion of solids excreted, while the quantity of fluid is increased. While of doubtful utility in *scarlatina*, it is very serviceable in the anasarcous condition sometimes following that disease. *Rheumatism*, with threatened heart failure, is sometimes relieved by digitalis. Owing to its power of preventing erections, by limiting the supply of blood to the erectile tissues, it has proven itself of service in *nocturnal seminal pollutions*, particularly when the extremities are cold, the erections feeble, and the emissions oft-occurring.

The leaves, bruised and mixed with warm water, and applied upon the abdomen as a cataplasm, or the tincture mixed with warm flaxseed poultice, has been successful in *urinary suppression*. So great was the cutaneous absorption in one case that an enormous diuresis followed, producing death by exhaustion. Without doubt many of the failures from the use of digitalis in properly selected cases are due to the quality of the drug employed. A recent study of digitalin by competent observers shows, however, that it is unreliable in therapy and does not adequately represent the crude leaf. In fact, the crude drug in infusion is, without doubt, the best preparation of digitalis for use in medicine, and that no uncertainty as regards quality should exist, the best English digitalis should be employed. The dose of digitalis, in powder, is from ½ to 1½ grains, repeated every 4 or 6 hours; of the tincture, from 3 to 20 minims; of specific digitalis, 1 to 3 minims; fluid extract, 1 to 2 minims; infusion (see *Infusum Digitalis*), ¼ to 1 fluid ounce. The infusion should always be well shaken before administration, lest, in case of precipitation of digitalin, which has been thought to occur, an inordinate quantity of the latter should be contained in the last dose administered. Weaker infusions than the official may be administered, and for diuretic purposes it should be remembered that its action is slow, sometimes not apparent until several days after administration. Consequently too much should not be given until its effects are produced, lest the cumulative effect should obtain. Of digitalin, from $\frac{1}{60}$ to $\frac{1}{50}$ of a grain in syrup, or in pill mass, may be given for a dose, if it be found desirable to use it—cautiously increasing to an amount not to exceed the $\frac{1}{16}$ of a grain.

Specific Indications and Uses.—Weak, rapid, irregular heart action, with low arterial tension; weak heart sounds; dusky countenance, jugular pulsation, cough, and dyspnœa; œdema; anasarca with scanty, high-colored urine; renal congestion. An antidote to aconite, but slow in its action.

Related Drugs.—*Coronilla scorpioides.* France. Cardot (1886) pronounces this leguminous plant an active heart poison. Its action is much like that of digitalis, both upon the heart and kidneys. Its effects, however, are more transient. A glucosid, *coronillin* ($C_{11}H_{12}O_5$), has been separated from it by Schlagdenhauffen and Reeb (1889). It is a yellowish powder, soluble in water, amyl alcohol, and acetone, slightly so in chloroform and ether. Treated with nitric acid, containing some cupric chloride, it produces a characteristic red coloration (*Amer. Jour. Pharm.*, 1891). If heated with hydrochloric acid (diluted) an amorphous, yellow resin (*coronillein*) is obtained; insoluble in water, but soluble in alcohol, chloroform, and acetone. It has no perceptible physiological action (*Amer. Jour. Pharm.*, 1889). Much uncertainty exists as to the size of the dose of this drug, one observer stating that ¾ grain is poisonous, while another recommends as high as 5 grains. It is suggested as a remedy for *cardiac dropsy.*

Mauwin Bark.—Mozambique. The bark of a tree employed by the natives of eastern Africa as an "*ordeal*" poison. It resembles sassy bark and contains an alkaloid (*mauwinum*), obtained by E. Merck, in 1891. Alcohol, chloroform, and ether dissolve it. Its action is considered similar to, but more transient than that of digitalin.

Urechites suberecta, *Savannah flower*, *Yellow-flowered nightshade* (*Nat. Ord.*—Apocynaceæ). West Indies. Violent emeto-catharsis with convulsions are the symptoms attributed to this plant, which is said to be used as a poison by the negroes of Jamaica. Two glucosids of the digitalis group are found in the plant: *Urechitin* ($C_{28}H_{42}O_8$) and *urechitoxin* ($C_{13}H_{20}O_5$). Small doses of the plant are said to depress the heart's action, and, in larger doses, nausea, vomiting, marked general depression, increased action of the skin, and slowing of the pulse, are attributed to it. Death is produced by cardiac paralysis. The fluid extract, in doses of from 2 to 10 drops, has been used in Jamaica in the treatment of *sthenic fevers.*

DIOSCOREA.—WILD YAM.

The rhizome of *Dioscorea villosa*, Linné.

Nat. Ord.—Dioscoreaceæ.

Common Names: *Wild yam*, *Colic-root*, *Rheumatism-root.*

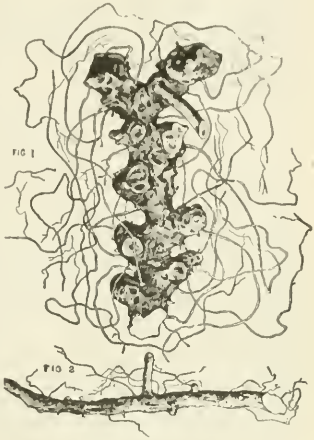
Botanical Source.—*Dioscorea villosa*, Linné. This is an herbaceous, slender vine, found throughout the United States, but more common in the central and southern portions. The stem is a smooth green twiner, about the size of a goose-quill, twining from the right to the left, over fences, bushes, etc. The leaves are symmetrical and heart-shaped, gradually tapering to a sharp, acuminate point, and are borne on leaf stalks from 2 to 4 inches long. The lower leaves are in whorls of 4 or 5, with intervals of from 6 inches to a foot between, while those on the upper part of the vine are irregularly alternate. The margins of the leaves are entire and wavy in the larger leaves. The veins are generally 9, quite prominent, and gradually diverge from the top of the leaf-stalk. The under side of the leaves is clothed with a thick pubescence. The flowers appear in June or July, are diœcious, very small, and greenish-yellow. The male flowers are in compound loose spikes, with from 3 to 5 slender branches; the perianth is 6-parted, sessile, flattened, and has, near the base, 6 minute stamens. The female flowers are placed at intervals of ¼ of an inch or ½ an inch apart, in simple, drooping, axillary spikes, consisting each, of from 4 to 8 flowers. The ovary is sessile, slender, about ¼ of an inch in length, bearing at the summit a 6-parted, small perianth, and 3 short styles. The female flowers are succeeded by dry, brown fruit, which remains hanging among the limbs of shrubs in winter for some time after the herbaceous stems of the plant have perished. They are sharply 3-angled, and have 3 cells, each cell bearing 2 (or often, by abortion, 1) flat, membranous-winged seed.

Dioscorea villosa, Linné, var. *glabra.*—This appears to be a distinct variety, chiefly differing from the preceding in the entire dissimilarity of its rhizome.

The plant closely resembles the true wild yam in its general shape and in the structure of its leaves, flowers, and fruit. The leaves, however, are *entirely glabrous*, and are not covered with a short pubescence underneath. The two plants likewise appear to differ in their manner of growth, the *D. villosa* often growing in dense clumps, while the variety *glabra* is generally found isolated. From the specific name given to this plant by Linnaeus, it is evident that he was possessed of a specimen of the pubescent kind (or the true wild yam), and we have ventured to apply the designation, var. *glabra*, to the variety distinguished by smooth leaves and knotty rhizome. Works upon botany recognize only *Dioscorea villosa*, but it has become necessary to classify the two rhizomæ of commerce. Considerable attention has been given by me to the plants, and without an exception the form of the rhizome was indicated by the pubescence of the under surface of the leaf. I am, therefore, led to hold to the foregoing distinctions until a better explanation is given (C. G. Lloyd).

History.—The rhizome of Dioscorea villosa is a favorite therapeutical agent among Eclectic physicians, who have advantageously used it for more than 60 years. It is known as *wild yam* and *colic root*. The first specimens employed were from the Dioscorea villosa, with pubescent leaves (Fig. 97), and now known as the *true wild yam*. About the year 1850, botanic druggists noticed the admixture by root-diggers of the rhizomæ represented by (Fig. 97, 1), and for a considerable time rejected it as an adulteration. The diggers insisted, however, that both "roots" were obtained from vines almost identical in appearance (although they can distinguish between them), and finally purchasers were compelled to accept them, more especially as the true rhizomæ became very scarce. The late Mr. H. M. Merrell, of Cincinnati, Ohio, to whom we are indebted for this information, stated that the first heavy shipments of the *false* "wild yam" root to Eastern houses were made about 1860, which article purchasers refused to accept, but after some correspondence, coupled with the fact that the true wild yam root could not at that time be obtained, the parties concluded to receive it. Since then the two rhizomæ have been sold indiscriminately, although but little of the original drug is to be found in the market. Eclectic physicians are aware of the difference between these rhizomæ, and refuse to use the "false" variety, insisting that it does not possess the medicinal properties, and can not safely be substituted for the "true." In this connection, we invite attention to the accurate engravings of each variety of the rhizomæ in Fig. 97.

Fig. 97.



1. Dioscorea villosa, var. glabra.
2. Dioscorea villosa.

The root loses its therapeutical virtues after the first year, and hence should be freshly gathered every year, and carefully dried. Water or alcohol extract its virtues. Several species of Dioscorea yield edible rhizomæ, generally known as "*yams*."

Description.—1. Dioscorea villosa, *True wild yam*. The rhizome of *Dioscorea villosa* (Fig. 97, 2), appears in market in slender, contorted pieces, from ¼ of an inch to ½ an inch in diameter, and often 2 feet in length. It is oval, being flattened above and below, as it creeps in a horizontal position beneath the surface of the ground. It seldom throws out branches, but occasionally little protuberances project from its sides being from ⅛ of an inch to an inch in length, and about ⅓ as large in diameter as the primary rhizome. They are rounding at the extremity, and seem to indicate an abortive attempt of the rhizome to throw out branches; but they do not send up the vine. Along the upper side of the rhizome are stem-scars, which are about ¾ of an inch apart. The epidermis is brown, thin, and scales off, more or less, upon drying, especially when the rhizome is gathered in the spring, but which is not the case with a good quality of it, when dug in autumn. The internal color of the dry rhizome is whitish, or slightly straw-colored, when gathered in the autumn, but it is often brown when collected early in the season; there is no bark to it. Under a magnifying glass the texture of a broken rhizome appears mealy and perforated with numerous woody bundles. Attached to the lower part of the rhizome, an abundance of strong, wiry-like fibers will be observed. *Dioscorea villosa* has one of the hardest of rhizomæ, it being very difficult to powder or crush. It has no odor, and but little taste beyond a slight acridity after prolonged chewing.

II. Dioscorea villosa, var. *glabra; False wild yam.*—The rhizome (Fig. 97, 1) of this plant resembles that of *Collinsonia canadensis* more nearly than it does the true *D. villosa.* It is found as a rough clump of a pound or more in weight when fresh, thickly branched, each branch shooting from the side of the main rhizome at an angle inclining backward and upward. The branches almost touch each other, are as large as the rhizome, and are from 1 inch to 3 inches in length. Along their upper surface are numerous cup-shaped stem-scars, which are about ¼ to ⅓ of an inch in diameter, and so thickly inserted as to intrude upon each other. (The vine of the true *Dioscorea villosa*, upon the contrary, springs from the *main rhizome*). The diameter of the rhizome and of the ramifications, is from ½ to ¾ of an inch, and the length seldom more than 6 inches. Internally, the rhizome resembles that of the true wild yam, while the lower portion is, in like manner, covered with stout, fibrous rootlets. The color is generally a very much darker brown.

Chemical Composition.—The virtues of this drug appear to reside in an acrid resin, almost insoluble in water, but readily extracted by alcohol. The so-called *dioscorein* is not a definite principle of the rhizome, but is simply a dried solid extract, and to call it otherwise is a misnomer. Kalteyer (1888) found a substance closely allied to *saponin* in considerable quantity in the rhizome. Wild yam contains an abundance of starch.

Action, Medical Uses, and Dosage.—In former editions I have termed this agent an antispasmodic, and solely for the reason that it cures *bilious colic.* And I can truly say that nearly all remedies have thus been classified, not from any positive knowledge of their action, but from the results following their administration. A change of classification based upon the known action of remedies is certainly desirable, and I am glad to observe that the attention of physicians has already been attracted in this direction. In the absence of any positive knowledge concerning the action of dioscorea, perhaps it would be better to say that it is a specific in bilious colic, having proved almost invariably successful in doses of ½ pint of the decoction, repeated every half hour, or hour. Specific dioscorea may be given in 5-drop doses every 5 minutes. No other medicine is required, as it gives prompt and permanent relief in the most severe cases (Prof. J. King). In fact it is not only of value in bilious colic, but in all forms of *colic* and other *painful abdominal neuroses*, and all forms of *gastro-intestinal irritation.* If it does not relieve in one hour, the medicine should be discontinued. It has allayed the pain incident to the passage of *biliary calculi* when given with full doses of gelsemium (Webster). It has also proved valuable in painful *cholera morbus* attended with cramps, in *neuralgic affections*, in *irritable conditions of the nervous system*, especially when attended with pain or *spasms*, in *spasmodic hiccough*, *obstinate* and *painful vomiting*, *gastralgia*, and in one case of *spasmodic asthma* Prof. King effected a cure with it after several other means had failed. It will likewise allay nausea, also spasms of the bowels, and, combined with equal parts of the bark of *Cornus sericea* in decoction, is eminently beneficial in the *nausea* and *vomiting of pregnancy.* This root appears to exert an action especially upon enfeebled and irritable mucous tissues that become painful from spasmodic contractions of their muscular fibers; hence its value in *bilious colic*, in *painful dysenteric tenesmus*, in *dysmenorrhœa* the result of spasmodic irritation of the mucous membrane of the cervix uteri, and in *spasmodic irritations of the gastric mucous membrane* attended with pain, nausea, and vomiting. It is reputed useful in *indigestion* with hepatic derangement, in *chronic hepatic congestion*, and in the *chronic gastritis of drunkards.* It is also useful in *after-pains.* In ordinary cases the decoction of the root may be given in doses of from 2 to 4 fluid ounces, and repeated every half hour until relief is obtained. By many the infusion or decoction is considered preferable to the tincture. The tincture is said to be a valuable expectorant and diaphoretic, and in large doses produces emesis. Dose of the tincture, from 20 to 60 drops; specific dioscorea, 5 to 40 drops.

Specific Indications and Uses.—Bilious colic; other forms of colic with spasmodic contractions; yellow skin and conjunctiva, with nausea and colicky pains; tongue coated, paroxysmal abdominal pain, and stomach deranged; frequent small, flatulent, alvine passages; colic, with tenderness on pressure; sharp abdominal pain, made worse by motion.

DIOSPYROS.—PERSIMMON.

The bark and unripe fruit of *Diospyros virginiana*, Linné.

Nat. Ord.—Ebenaceæ.

COMMON NAMES: *Persimmon, Date-plum.*

Botanical Source.—This is an indigenous tree growing from 15 to 50 feet or more in height, its dimensions being larger at the South; the bark is rough and dark-colored; the branches alternate and spreading. The leaves are alternate, elliptic or ovate-oblong, abruptly acuminate, from 3 to 5 inches long, entire, smooth, shining, and glaucous beneath; the petiole, veins, and margin are puberulent. The flowers are obscure, pale, greenish-yellow, the fertile ones in axillary racemes, 1 to 3-flowered, the pedicels being shorter than the flowers; the sterile flowers are smaller and often clustered. Stamens 16 in the sterile flowers, 8 in the fertile, in the latter imperfect; the anthers of the sterile flowers are bilobed. The style is 2 to 4-cleft, and short; the stigma obtuse and spreading. The fruit is a round, golden-yellow berry, about an inch in diameter, containing a sweet and edible pulp, and from 6 to 8 hard, compressed seeds (W.—G.).

History.—This is a well known indigenous tree, growing in woods and fields from Rhode Island to the western states and southward, flowering from April to July, ripening its fruit in September and October. The fruit is edible after exposure to frost. The unripe fruit and the bark are very astringent, and are the medicinal portions of the tree. (For *description of fruit* see *Botanical Source*). A beer is sometimes made from the fruit, and the fruit is made into a bread with wheat bran, known as *persimmon bread*, and then kept for the purpose of making beer by means of fermentation with hops. The roasted seeds have been used in some portions of the South as a substitute for coffee.

Chemical Composition.—Water or alcohol extracts the virtues of the bark and unripe fruit. B. R. Smith found the unripe fruit to contain lignin, tannic acid, sugar, a little malic acid, and coloring matter; also, that when ripe the tannic acid almost disappears, while the sugar and malic acid become more abundant (*Amer. Jour. Pharm.*, 1846, 167). J. E. Bryan (1860) also found pectin present, and thought the tannin to be analogous to that of cinchona, catechu, etc., while others contend that it is identical with the tannin from oak and galls. The bark of persimmon was analyzed by F. E. Murphy (1889), and a crystalline body obtained by him from the ethereal extract investigated by Schleif (*Amer. Jour. Pharm.*, 1890). He found it to be free from nitrogen, and allied to the resins.

Action, Medical Uses, and Dosage.—Tonic and astringent. The bark has been used in *intermittents*, and both it and the unripe fruit have been beneficial in various forms of *disease of the bowels, chronic dysentery*, and *uterine hemorrhage;* used in infusion, syrup, or vinous tincture, in the proportion of 1 ounce of the bruised fruit to 2 fluid ounces of the vehicle, and ½ fluid ounce or more given to adults, and a fluid drachm or more to infants. The infusion may be used as a gargle in *ulcerated sore throat.* When ripe the fruit is very palatable, and as it matures at a time when fruits are generally departing for the season, the cultivation of the tree would undoubtedly be a valuable accession to our autumnal fruits. A kind of brandy is obtained by distillation of the fermented infusion.

Related Species.—*Diospyros Kaki*, Linné filius, the *Chinese date-plum* or *Japanese persimmon*, is a native of China and Japan, and is cultivated in India. The fruit is of a bright-red color, about the size of an ordinary apple; when ripe, it is eaten by the Chinese, and when dried, is made into sweetmeats. The bark is astringent, and probably resembles that of other species of *Diospyros*. The Japanese regard this persimmon as their best fruit, which they even eat before it ripens. When dried it resembles the fig. When fresh, and eaten with sugar and cream, it is said to be delicious. It is now cultivated in Florida (*U. S. Agr. Rep.*, 1890). J. Ishii, of Tokio, in 1895, found in the unripe fruit a considerable amount of tannin which disappears upon ripening; the pulp contains much dextrose and lævulose, while the seeds, being free from starch, contain a soft white material, *mannane*, convertible into *mannose* by boiling with 5 per cent of sulphuric acid (*Proc. Amer. Pharm. Assoc.*, 1896, p. 574).

The bark of *Diospyros Kaki* has been advised as an astringent in *chronic mucous affections*, as in certain forms of *dyspepsia*, in *diarrhœa* and *dysentery*, in *mucous diseases of the bladder and urethra*, and as a local application in *leucorrhœa*, *gleet*, *chronic conjunctivitis*, and *catarrhal affections*. The fluid extract, diluted with water, may be applied locally, by injection, or by spray. By some physicians kaki is highly lauded as a remedy for *gastro-intestinal irritation*. Dr. J. W. Huckins (see Webster's *Dynam. Therap.*, p. 359), regards it as an excellent remedy for *dysentery*, *simple mucoid diarrhœa*, *chronic diarrhœa*, and *diarrhœa of typhoid fever*, quickly relieving pain, tenesmus, and thirst, and checking the discharges; he also praises it in *gastric catarrh*, *ulceration of the stomach*, or *bowels*, and in *catarrh of the rectum* and *colon*. A decoction of 1 or 2 drachms of kaki to ½ pint of water, steeped ½ hour and cooled, is employed in doses of 1 to 4 tablespoonfuls every 1 to 4 hours as required.

Diospyros obtusifolia, Willdenow; Mexico. Bark and leaves employed. Astringent tonic.

Diospyros embryopteris, Persoon, or *Indian persimmon tree*, is found in India, Java, and neighboring tropical islands; but is not valued highly for its fruit, which is insipid. When green, they are very astringent, and are employed in tanning. The inspissated juice has been used in *diarrhœa;* it is thick and viscid, and has been employed in India as a preservative for coating fishing nets, and the seams of boats. The unripe fruit was admitted into the *Pharmacopœia of India* in the year 1868.

DIRCA.—LEATHERWOOD.

The bark of *Dirca palustris*, Linné.

Nat Ord.—Thymelæaceæ.

Common Names: *Leatherwood*, *Moosewood*, *American mezereon*, *Wickopy*.

Botanical Source.—This indigenous shrub attains the height of 5 or 6 feet, having crooked, jointed, and spreading branches. The leaves are alternate, simple, entire, on very short petioles, oblong-ovate, or obovate, downy when young, smooth and membranous when fully grown, and pale underneath. The flowers are axillary, yellow, appear long before the leaves; when young they are inclosed within a small, hairy, bud-like involucre, occupying a sheath or cavity in the end of each flowering branch, usually in bunches of 3 together, with their peduncles cohering. Corolla none. Calyx funnel-shaped, ½ inch long, with a contraction near the base and another in the middle. The stamens are 8 in number, much longer than the calyx, alternately a long and a short one, with rounded anthers. The ovary is ovate, placed obliquely, the style appearing to issue from one side; the style filiform, curved, longer than the stamens, and terminated by an acute stigma. The fruit is a small, oval, red or orange-colored berry, containing one seed (B.—W.).

History, Description, and Chemical Composition.—This shrub is more common to the northern and eastern states, being occasionally met with in the west. It inhabits marshy places, low swampy woods, flowering in April and May. The bark is the part used; it is very tenacious and fibrous, and hard to pulverize. It has a disagreeable odor, and a pungent taste, with considerable acrimony, producing ptyalism, which property it imparts to alcohol, and slightly to boiling water. It has been used for making ropes, thongs and baskets, and might be advantageously employed in the arts, for making paper, etc. The wood is white, soft, and very brittle. It has not been satisfactorily analyzed, though mucilage, an acrid resin, and bitter extractive have been found in it.

Action, Medical Uses, and Dosage.—The bark is acrid, rubefacient, and vesicant when fresh. From 5 to 7 grains of it cause great gastric heat and uneasiness, with emesis and catharsis. In contact with the skin it produces rubefaction, followed by blisters, and the sores it occasions are frequently difficult to heal, forming very indolent and obstinate ulcers. If chewed it causes salivation, with burning pain in the tongue, gums, etc., and has thus proved useful as an irritant in *paralysis of the tongue*, *toothache*, *facial neuralgia*, etc. Bigelow says, that a decoction of the bark may be used as a sudorific and expectorant, in the place of senega. The berries produce vomiting, and are said to be a narcotic poison.

DRACONTIUM.—SKUNK-CABBAGE.

The rhizome, roots and seeds of *Dracontium fœtidum*, Linné (*Ictodes fœtidus*, Bigelow; *Pothos fœtida*, Michaux; *Symplocarpus fœtidus*, Salisbury).

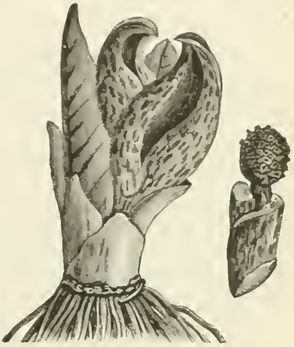
Nat. Ord.—Araceæ.

COMMON NAMES: *Skunk-cabbage*, *Skunk-weed*, *Meadow-cabbage*, *Polecat-weed*, *Fœtid hellebore*.

ILLUSTRATIONS: Millspaugh's *Amer. Med. Plants*, Plate 169; Meehan's *Native Flowers and Ferns*, Vol. 1, Plate 15.

Botanical Source.—Skunk-cabbage is a perennial plant, having a large, abrupt root or tuber, with numerous, crowded, verticillate, fleshy fibers, which extend some distance into the ground. The spathe, which appears before the leaves, is ovate, turgid, various in width, cucullate, spotted and striped with purple and yellowish-green, the top acuminate and incurved, the edges folded inward, auriculate at the base and at length coalescing. The flowers are dull-purple, tetrandrous, numerous, and situated within the spathe on an oval or subglobose, short pedunculated spadix. The calyx consists of 4 fleshy, wedge-shaped, truncate sepals, having the top and edges inflected. Corolla none. Stamens 4, opposite the sepals, with subulate filaments equal in length to the calyx; and oblong, exserted, 2-celled anthers. The style is 4-sided and tapering; the stigma minute and pubescent; the ovary roundish and concealed within the spadix.

Fig. 98.



Dracontium fœtidum.

After the spathe decays, the spadix continues to grow, and with it every part of the flowers except the anthers. When the fruit is ripe, the spadix has attained many times its original dimensions, while the calyx, filaments, and style are larger, very prominent and separated from each other. Within the spadix, at the base of each style, is a naked, round, fleshy seed, as large as a pea, white, tinged with green and purple, invested with a separate membranous coat, and with a prominent embryo situated in a depression at the top, and umbilicately attached to a large, solid perisperm. Sometime following the flowers, numerous large, crowded leaves appear, which are oblong, cordate, acute, and smooth, with numerous fleshy veins of a pale color, and are borne on long, channeled petioles, furnished with large, oblong sheaths, and are of bright-green color, and often 20 inches long by 12 broad (L.—G.—W.).

History.—This plant has been a troublesome one for botanists to dispose of. It has been variously annexed to *Ictodes*, *Dracontium*, and *Pothos*. Salisbury termed it *Symplocarpus*, a name which is preferred by many botanists. It is indigenous, growing plentifully in various parts of the United States, in moist grounds, flowering in March and April, and maturing its fruit in August and September. It forms a roughened globular mass, 2 or 3 inches in diameter, in decay shedding the bulblet-like seeds, which are ⅓ to ½ an inch in diameter, and filled with the singular, solid, fleshy embryo (G.). The whole plant has an extremely disagreeable odor, resembling the commingled odors of skunk and onions, which is most apparent when the plant is bruised, and which has given rise to the several names of *Skunk-cabbage*, *Skunk-weed*, *Polecat-weed*, and *Meadow-cabbage*. The parts used are the rhizome, with its rootlets, and the seeds. The rhizome should be gathered soon after the appearance of the spathe, or after the seeds have matured in autumn. It has the unpleasant odor of the plant, and, when fresh, a persistent, acrid taste.

Description and Chemical Composition.—As found in commerce the drug is in somewhat cylindrical pieces, 2 inches or more in length, and about 1 inch in diameter, or, more commonly, in tranverse slices, very much compressed and corrugated. Its color externally is dark-brown, and internally whitish, or yellowish-white. Drying lessens the odor as well as the acridity of the plant, and age and exposure dissipate them entirely, consequently the root should be renewed annually. The seeds have been used and preferred as being more energetic than the root. They have an exceedingly acrid taste, and emit the fetid odor of the plant only when bruised. They preserve their virtues longer than the root. The properties of this plant are chiefly owing to a volatile substance, which loses its activity by desiccation, and is completely volatilized by subjection to an increased temperature. Alcohol or water extracts its virtues, and the aqueous infusion should be made by displacement. As far as we can ascertain, the only analysis on record of Symplocarpus fœtidus is that of Mr. Jos. M. Turner (*Amer. Jour. Pharm.*, 1836, Vol. VIII, pp. 1–10), who found the root to contain besides starch, fixed and volatile oils, "a peculiar substance, soluble in acids and precipitated by alkalies." In the seeds he found starch, gum, resin, albumen, fixed oil, wax, and coloring matter.

Prof. Bastin showed the starch of Symplocarpus fœtidus to be so characteristic of the drug as to allow its identification in cases where it is used as an adulterant of commercial Veratrum viride (*The Apothecary*, 1893, p. 152).

Action, Medical Uses, and Dosage.—In large doses, according to Bigelow, skunk cabbage will cause sickness at stomach, vomiting, headache, dizziness, and impaired vision. In medicinal doses it is a stimulant, exerting expectorant, powerful antispasmodic, and faintly narcotic influences. Its action upon the nervous system is marked, relieving irritation, and it has a tendency to promote normal functional activity of the nervous structures. It has been successfully used in *asthma*, *whooping-cough*, *nervous irritability*, *hysteria*, *epilepsy*, and *convulsions during pregnancy and labor;* likewise in *chronic catarrh*, *pulmonary*, and *bronchial affections*. The powdered root or seed may be given in doses of from 10 to 40 grains, 3 times a day; but the most eligible mode of administration is a saturated tincture of the fresh root, of which 1 or 2 fluid drachms may be given for a dose. It enters into the composition of *Acetous Emetic Tincture*, *Compound Emetic Powder*, and several other old Eclectic preparations.

DROSERA.—SUNDEW.

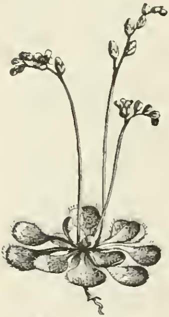
The herb *Drosera rotundifolia*, Linné.

Nat. Ord.—Droseraceæ.

Common Names: *Sundew*, *Round-leaved sundew*.

Botanical Source.—Sundew is a low, small, perennial, herbaceous, aquatic plant, also called Round-leaved sundew, with a fibrous root, from which arises the leaves, which are radical, small, and nearly round, depressed, lying flat upon the ground, and abruptly narrowed into the spreading hairy petioles. The scapes are erect, 5 to 8 inches high, at first coiled inward, and bearing a simple raceme. The flowers are arranged on one side, very small and white; the sepals are 5, united at the base, and persistent; the petals 5 and convolute. The stamens 5; anthers adnate; styles 3 or 5, each deeply 2-parted. Ovary single. Capsule 3 or 5-valved and many-seeded. The seeds are spindle-shaped, and the coat loose and chaff-like (W.—G.).

Fig. 99.



Drosera rotundifolia.

History.—Sundew (*Ros Solis*) is a peculiar little plant, growing in Europe and this country, in bogs, and muddy shores of ponds and rivers, and flowering in July and August. It may be at once distinguished by the reddish glandular hairs with which the leaves are beset, and which are usually tipped with a small drop of a clammy fluid, appearing like a dew drop, glistening in the sun, this secretion being most abundant when the sun is at its highest, from which circumstance it derives its name. The long, shining red hairs of this plant form beautiful objects for the microscope, under which they are seen to consist of an immense number of minute cells, regularly arranged, and exhibiting a most gorgeous variety of brilliant colors. They are very irritable, slowly curved inward, and entrap insects within their reach; the fluid secreted from their points also retains insects which settle upon it. The flowers only open in sunshine. The juice of the plant is bitter, acrid and caustic. The medicinal preparation is the tincture of the recent plant.

Chemical Composition.—Trommsdorf examined the juice of this plant (*Chem. Centralbl.*, 1833), finding in it a free organic acid, probably malic acid, organic salts, and a red coloring principle, which formed an insoluble compound with acetate of lead. Reess and Will believed the free acid to be a mixture of formic, propionic and butyric acids, and Hager thought it to be malic and citric acids combined. Lugan obtained from the juice of the plant a crystallizable acid insoluble in chloroform; besides, a greenish-brown resin, by successive treatment with ether and chloroform. It is soluble in both these solvents and possesses acrid properties. According to Stein's experiments (*Ber. d. Deutsch. Chem. Ges.*, 1879; also *Amer. Jour. Pharm.*, 1880, p. 12), the free acid in Drosera intermedia was identified with citric acid, which acid probably occurs in all species of Drosera. A ferment also seems to be present, capable of converting albuminous substances into peptones. Experiments of H. Büsgen (see *Amer. Jour. Pharm.*, 1885, p. 106) would demonstrate that the plants of drosera are capable of assimilating animal food.

Action, Medical Uses, and Dosage.—This agent appears to exert a peculiar action upon the respiratory apparatus, and its effects are best observed from the use of small doses. It is peculiarly adapted to dry, spasmodic, or explosive *coughs*, such as are met with in many cases of *whooping-cough* and *measles*—for the cough of the latter it being an almost absolute specific. The coughs met by drosera are those in which dryness of the air passages is marked, and there is irritation or even inflammation, and nervous irritation, particularly irritation of the base of the brain and of the parts supplied by the vagus. The special seat of most of the trouble seems to be centered in the larynx. Tickling in that organ, giving rise to spasmodic cough, is met by it, and while exceedingly useful in all coughs having the above characteristics, it appears to benefit best those cases associated with or following measles and whooping-cough. For the latter it may also be given as a prophylactic, and if the individual does contract the disease, the influence of the medicine will have been early obtained. Sanguinarine nitrate acts well with it in dry, tickling cough. It has been found essentially useful in *asthma*, *incipient phthisis*, *chronic bronchitis*, with dry, spasmodic cough, and *nervous* or *sympathetic cough*, whether from pulmonary, cardiac, or gastric disease. Two fluid drachms of the saturated tincture, or 1 drachm of specific drosera, may be added to 4 fluid ounces of water (or wine, if indicated), of which a teaspoonful may be administered every 3 or 4 hours. In former times it was considered a powerful aphrodisiac, and as a remedy to cure *intermittents*, *insanity*, and to promote *delivery*. The juice of the plant has been used as a local application for the cure of *corns* and *warts*. Dose, of the saturated tincture, 1 to 5 drops; specific drosera, $\frac{1}{10}$ to 5 drops.

Specific Indications and Uses.—Expulsive or explosive, spasmodic cough, with dryness of the air passages; whooping-cough; cough of measles; uncontrollable irritating cough.

DUBOISIA.—DUBOISIA.

The leaves of *Duboisia myoporoides*, Robert Brown.

Nat. Ord.—Solanaceæ.

COMMON NAMES: *Corkwood elm*, *Orungurabie*, *Ngmoo* (native names).

Botanical Source.—This is a large shrub found in Australia and New Caledonia. It has alternate, smooth, entire leaves, narrowed into a short leaf-stalk, which is articulated to the branches. The flowers are small, white, and disposed in large terminal panicles. The calyx and corolla are 5-parted, with obtuse lobes. The stamens are didynamous, with the rudiment of a fifth, and bear 1-celled anthers. The fruit is a small, black, 2-celled berry, which contains a few reniform, rough seeds. The genus *Duboisia* is intermediate between the natural orders *Solanaceæ* and *Scrophulariaceæ*, and was referred to the former by the older authors; Bentham, in the *Flora of Australia*, classes it with the latter, but more recent developments regarding a natural constituent (*duboisine*), seem to indicate that its true place is among the Solanaceæ.

History.—The honor of introducing this drug to the profession belongs to Dr. J. Bancroft, of Brisbane, Australia, who presented the plant to Baron von Mueller for botanical identification, and who, at his suggestion, experimented with it as a therapeutical agent, and presented the first paper on the subject to the Queensland Philosophical Society of Australia, in October, 1877. Shortly afterward, he (Bancroft) sent specimens of the plant to the Museum of the British Pharmaceutical Society. In March, 1878, Mr. E. M. Holmes read a paper before the society on *Duboisia myoporoides*, its botanical history, etc., and nearly at the same time, a communication appeared in the *London Lancet* from Drs. Ringer and Tweedy, detailing a line of experiments upon its therapeutical action, in which the previous report of Dr. Bancroft was corroborated in every particular. Shortly afterward, Gerrard, of England, and Petit, of France (see *Pharm. Jour. Trans.*, [3], Vol. VII, p. 787), almost simultaneously announced the discovery of an alkaloid called *duboisine* or *duboisina*. F. von Mueller and L. Rummell also announced their discovery of *duboisine* from D. myoporoides (*Jour. Chem. Soc.*, January, 1879, p. 32), but as their alkaloid is an oily, volatile base, its identity with duboisine is questionable.

Chemical Composition.—The chief constituent of this leaf, called duboisine by its discoverers, was found by Prof. A. Ladenburg to be identical with *hyoscyamine* ($C_{17}H_{23}NO_3$) (*Ber. d. Deutsch. Chem. Ges.*, 1880, p. 1257). The properties of duboisine are therefore described under *hyoscyamine* (see *Hyoscyamus*). Another isomeric alkaloid was obtained by Merck, called *pseudo-hyoscyamine*, forming yellowish needles of an acrid, bitter taste, soluble in alcohol and chloroform, slightly soluble in ether. Its melting point is 133° to 134° C. (271.4 to 273.2° F.), while *hyoscyamine* (duboisine), melts at 106° to 108° C. (222.8° to 226.4° F.) (Merck's *Index*, 1896).

Action, Medical Uses, and Dosage.—The action of duboisia upon man and animals is very similar to that of belladonna, hyoscyamus, etc. Dogs and cats to which it has been administered, almost immediately commence walking with difficulty, stumbling over the least obstacle as though they were blind, and falling asleep as soon as they are left at rest, having the pupils largely dilated; these results also followed its introduction into the system by hypodermatic injection. Large doses internally, or by subcutaneous injection, occasion large pupillary dilatation, dryness of the mouth and throat, increase the number of pulsations, and give rise to general debility, vertigo, and cephalalgia; the results are the same with man as with animals. The alkaloid, duboisine, produces similar effects. The sulphate of this alkaloid, subcutaneously injected in large doses, occasions a sort of intoxication, mental derangement, pupillary dilatation, incoordination of muscular motion, relaxation of the vesical and anal sphincters, and an increased temperature at first, succeeded by a very marked diminution.

As an internal remedy, neither the shrub nor its alkaloid (except as hyoscyamine) have come into general use. Used in this manner, duboisia will be found to possess properties similar to those of belladonna and its congeners. Duboisine, and its sulphate, are more commonly employed in this country, principally in ocular therapeutics; it has been found by Drs. Wecker and Galezowski, of Paris, to be a prompt and unirritating mydriatic, the mydriasis being accompanied with paralysis of the ciliary muscle, and consequently an absolute loss of accommodation. The mydriasis produced does not appear to annoy the patient, nor to last as long as when occasioned by atropine; nor does the employment of the agent give rise to the intense conjunctival irritations (follicular conjunctivitis and eczema of the lids) so often following the application of atropine. It may be employed in all *maladies of the eyes* in which atropine is indicated, being contraindicated in glaucomatous conditions, and in diseased conditions of the fundus. From 2 to 4 grains of the sulphate of duboisine are dissolved in 1 fluid ounce of water, and of this solution from 2 to 5 drops may be instilled into one or both eyes as required; the mydriatic effect commences in a few minutes. The solution of the sulphate of duboisine has likewise been successfully employed, by hypodermatic injection, for checking the pathological *sweatings common to phthisis*, etc., and also as an antidote to *poisoning by mushrooms*, antagonizing the paralyzing effect of muscarine on the heart. It is reputed palliative in *exophthalmic goitre.* The dose to be used will differ with various individuals, from the $\frac{1}{80}$ or $\frac{1}{30}$ to $\frac{1}{20}$ grain. The beginning dose should rarely exceed $\frac{1}{70}$ grain. For ophthalmic use 1 to 4 grains to 1 ounce of distilled water. Care should be had in its use, as occasionally untoward symptoms have been produced by reduced applications (see also *Atropinæ Sulphas*, *Belladonna*, and *Hyoscyamus*).

Specific Indications and Uses.—A substitute for atropine as a mydriatic, and to check colliquative sweating; antagonizes muscarine; mushroom poisoning.

Related Species.—*Duboisia Hopwoodii*, F. von Mueller. This is the Australian *Pitury*, also known as *piturie*, *pedgery*, *pitchiri*, *pitchery*, and *bedgery*. It has long been known that the natives of Central Australia use the leaf of some shrub in order to invigorate themselves, after long marches, or when they are desirous of undergoing great fatigue, as during a battle. This leaf is used as a masticatory by the Australians in a manner similar to that of the coca leaves by the South Americans. It is asserted that when the natives chew pitury "in company," the quid is passed from one to another until all are satisfied, when one of the number preserves it by sticking it behind his ear (Maiden, *Australian Useful Plants*). Dr. Bancroft, of Brisbane, in 1872, made some physiological experiments with authentic specimens of pituri; yet the source of the drug was unknown until 1877, when Baron von Mueller identified it from a specimen of the leaves of the plant submitted to him by Mr. W. O. Hodgkinson; accordingly, the pitury is *Duboisia Hopwoodii*, F. Mueller, a shrub found sparingly "from the Darling River and Barcooto to West Australia." But little is known of this shrub, as it grows in a country difficult of access. Staiger is probably the first who isolated from Duboisia Hopwoodii *piturine*, an alkaloid with which the "duboisine" of F. von Mueller and F. Rummel (see above), is most probably identical. A. W. Gerrard, in 1880, independently discovered the alkaloid *piturine* in this plant (*Pharm. Jour. Trans.*, 1880). When fresh it smells like nicotine, but when older has a smell of pyridine. Its vapors affect the mucous membranes and cause violent headache. Some authorities (*e. g.*, Petit, *Jour. Pharm. Chim.*, 1879, p. 338), consider *piturine* identical with *nicotine*. Prof. Liversidge, however, points out some differences in their reactions, but otherwise they are quite similar (*Amer. Jour. Pharm.*, 1881, p. 357). Piturine ($C_{12}H_{16}N_2$), was obtained by him in the amount of 1.0 and 2.4 per cent. It is a colorless alkaloid, volatile at ordinary temperatures, changing to yellow and brown rapidly when exposed to air and sunlight. It is soluble in water, alcohol, and ether, is slightly heavier than water, and forms salts with acids, which, with oxalic acid, are capable of crystallizing. Its salts gradually lose the alkaloid by evaporation. *Piturine* is reported to antagonize the action of muscarine on the heart, but not so promptly as atropine. Dr. Bancroft states that this drug arrests the respiration of animals, and thus causes their death. The action of pitury is essentially different from that of duboisia. Applied to the eye, it first contracts, and then widely dilates the pupils; internally, small doses contract the pupils, while large doses produce a wide dilatation. Faintness, giddiness, trembling, pallor, quickened and shallow breathing, increased heart action, and sweating, are induced by it, and if the dose be large, drowsiness, ptyalism, spasmodic muscular twitching, and spasmodic rigidity of the limbs are among its effects.

DULCAMARA (U. S. P.)—DULCAMARA.

"The young branches of *Solanum Dulcamara*, Linné" (*U. S. P.*).

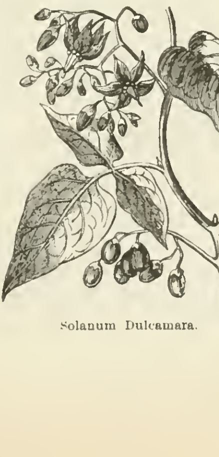
Nat. Ord.—Solanaceæ.

COMMON NAMES: *Bittersweet*, *Woody night-shade*, *Violet-bloom*, *Scarlet-berry*.

ILLUSTRATIONS: Bentley and Trimen, *Med. Plants*, 190; Woodville, *Med. Bot.*, 133.

Botanical Source.—Bittersweet, or Woody night-shade, is a woody vine, having a woody root, with a shrubby, flexuous, thornless, and branching stem, several feet in length; with an ashy-green bark on the stem and large branches. The leaves are alternate, acute, and generally smooth; the lower ones ovate or cordate; the upper ones more or less perfectly hastate, and all entire. The flowers are purple, drooping, and are borne on branching peduncles from the side of the stem, in spreading, cymose clusters. The calyx is very small, purplish, acute, persistent, and 5-parted. The corolla is rotate, purple, with 5 reflexed segments, and 2 round, green spots at the base of each segment. The filaments are short; the anthers erect, opening by pores at the apex, yellow, and converging into a cone. Ovary roundish; style filiform; stigma simple and obtuse. The fruit is a scarlet, oval, juicy, bitter, and poisonous berry, the seeds of which are many, plano-convex, and whitish (L.—W.—G.—B.).

Fig. 100.



Solanum Dulcamara.

History and Description.—Bittersweet, also known by the names of *Violet-bloom* and *Scarlet-berry*, is common to both Europe and this country, growing on moist banks, around dwellings, and in low, damp grounds, about hedges and thickets, flowering in June and July. Its berries are ripened in autumn, and hang upon the vines for several months. The parts used in medicine are the roots and twigs, the latter only being official. The berries when eaten have certainly produced serious consequences, though considered by many to be harmless. The twigs should be collected in the autumn, after the dropping of the foliage; they have an unpleasant odor, which is lost by drying; and their taste is bitter, followed by some sweetness and a slight acridity. The dried twigs found in commerce are in pieces varying in length, having a greenish-gray epidermis, a light wood, and a very light and spongy pith. They impart their properties by infusion to boiling water, and also to diluted alcohol; long boiling impairs their medicinal activity. The *U. S. P.* describes dulcamara as follows: "About 5 Mm. [$\frac{1}{5}$ inch] or less thick, cylindrical, somewhat angular, longitudinally striate, more or less warty, usually hollow in the center, cut into short sections. The thin bark is externally pale greenish, or light greenish-brown, marked with alternate leaf-scars, and internally green; the greenish or yellowish wood forms 1 or 2 concentric rings. Odor slight, taste bitter, afterwards sweet"—(*U. S. P.*).

Chemical Composition.—Two proximate principles have been obtained from Solanum Dulcamara: *Solanine*, an alkaloidal principle, discovered by Desfosses, in 1820, in the berries of Solanum nigrum, and (1821) in the leaves and stems of *S. Dulcamara;* and *dulcamarin*, its bitter-sweet glucosid, was first isolated in pure form by E. Geisler, in 1875. Probably it is identical with a substance previously named *picroglycion* by Pfaff, and *dulcarin* by Desfosses (1821). It was again obtained by Biltz (1841), and later by Wittstein, who named it *dulcamarin*.

Peschier (1828) demonstrated that solanine existed in the berries of dulcamara in even larger quantity than in the leaves and stem; it also occurs in the sprouts of our common potato (see *Solanum tuberosum*, *Related Species*) and in various other Solanaceæ, *e. g.*, the tomato plant (G. W. Kennedy, *Amer. Jour. Pharm.*, 1873), etc. Desfosses obtained it from the ripe berries of the black night-shade (*Solanum nigrum*) by expressing the juice, adding ammonia, washing the precipitated alkaloid with cold water, and crystallizing from alcohol, after purifying with animal charcoal. Fresh sprouts of potatoes furnish it in greatest abundance.

Solanine ($C_{43}H_{69}NO_{16}$, Kraut; $C_{42}H_{87}NO_{15}$, Hilger) occurs either amorphous, in minute prisms, or in feathery crystals, having a bitter, somewhat acrid taste. Solanine fuses at 235° C. (455° F.). It is soluble in warm amyl alcohol, which abstracts it completely from alkaline solutions; is less soluble in boiling alcohol, still less in cold alcohol, considerably less in ether (1 in 4000), and requires 8000 parts of boiling water for solution. The solution of solanine in alcohol tends to gelatinize upon cooling; the solution in amyl alcohol possesses this property in a pronounced degree (Dragendorff). Solanine has an alkaline reaction and combines with acids to form salts. Dilute mineral acids decompose solanine slowly at ordinary temperatures, and more rapidly at boiling heat, into sugar and *solanidine*, another alkaloid which is soluble in cold ether and hot alcohol, but hardly soluble in water (Zwenger and Kindt, also Gmelin, 1859). O. Bach (1873) recommends as a test for solanine and solanidine, the behavior of these substances towards a mixture of equal volumes of concentrated sulphuric acid and alcohol; a trace of these alkaloids causes the appearance of a rose-red, then cherry-red color, which lasts for 5 or 6 hours, and is not interfered with by the presence of large quantities of morphine (*Amer. Jour. Pharm.*, 1873).

Dulcamarin ($C_{22}H_{34}O_{10}$) was obtained by E. Geissler (*Archiv. der Pharm.*, 1875, p. 293) from the stems of dulcamara, by digesting the aqueous infusion with animal charcoal until the peculiar, bitter-sweet taste was removed, washing the charcoal with water and abstracting by means of alcohol. After purification of the bitter-sweet extractive (by using of its lead compound), pure *dulcamarin* was obtained free from nitrogen (Wittstein's dulcamarin contained nitrogen), as an amorphous yellow substance, possessing the characteristic, bitter-sweet taste of the plant in concentrated form. It is soluble in alcohol and water (30 parts) and in acetic ether, but it is insoluble in ether, chloroform, and petroleum ether. Diluted sulphuric acid splits it into *dulcamaretin*, a tasteless, resinous substance, and sugar. Solanine is poisonous.

Action, Medical Uses, and Dosage.—Prof. Caylus, of Leipsic, who has made some careful experiments with solanine, as well as with the twigs of dulcamara, states that an extract of the twigs is from 5 to 10 times more active than the twigs, and solanine is 30 times more powerful than this extract. He considers the plant and its active principles to possess poisonous properties, which may prove fatal in large doses. All these preparations, when administered internally, cause renal congestion, and occasionally an augmented urinary secretion of an albuminous nature; they exert a depressing or paralyzing influence upon the respiratory nervous system, cause increased but enfeebled cardiac action, tetanic spasms of the thoracic muscles as well as those of the extremities, and increase the sensitiveness of the cutaneous nervous system; they exert no direct influence upon the brain, stomach, or bowels. He believes they act more particularly on the spinal cord and medulla oblongata, and recommends the acetate of solanine, in doses of $\frac{1}{6}$ to 1 grain, in *pulmonary maladies*, attended with spasm or irritation (*Ann. de Thér.*, 1859, p. 24).

Solanum Dulcamara is a mild narcotic, diuretic, alterative, diaphoretic, and discutient. In large doses it causes dryness and heat with stinging pain in the fauces, accompanied with thirst, sickness at stomach, vomiting, diarrhœa, prostration or syncope, and spasmodic twitchings. With some persons it depresses the action of the heart and arteries, and causes a moderate degree of lividity on the hands and face. The head usually feels heavy and dizzy, and a cutaneous erythema may be developed. It is reputed antaphrodisiac, and has proved beneficial in *mania* attended with powerful excitement of the venereal functions. On the other hand, it is said to occasion venereal desires, and to induce heat and itching of the external female parts, attended with strangury.

Dulcamara is a valuable remedy in most *acute troubles*, brought on by *colds*, and in *chronic skin affections* of a pustular, vesicular, or scaly character. It has been chiefly used in syrup or decoction in *cutaneous diseases*, *syphilitic diseases*, *rheumatic* and *cachectic affections*, *ill-conditioned ulcers*, *scrofula*, *indurations from milk*, *leucorrhœa*, *jaundice*, and *obstructed menstruation*. It is of more benefit in scaly cutaneous diseases than in others, as in *leprosy*, *tetter*, *eczema*, and *porrigo*, and especially in combination with guaiacum and yellow-dock root.

Dulcamara is a remedy for *catarrhal troubles*, resulting from cold or suspended cutaneous action. Here the fractional doses should be employed. *Suppression of the menses*, with headache, nausea, and chilly sensations, when the flow has been arrested by cold, is a case for its exhibition. *Dyspnœa*, *cough*, and *pain in the chest* produced by exposure, are relieved by small doses. *Catarrhal headache*, from acute colds, and *nasal catarrh* are both benefited by bitter-sweet, which is also a remedy for *retrocession of eruptions*, and to primarily develop tardy eruptions. Owing to its kindly action on the stomach and its influence in aiding secretion and excretion, it is a valuable alterative and should have a more general use. In *vesical catarrh*, aggravated by dampness, it has given good results. The same is true of *catarrhal diarrhœa* of children, and *acute* and *chronic rheumatism* in those who are much exposed or who dwell in cold or damp quarters. *Nymphomania* and *satyriasis* were successfully treated with it by Dewees. *Pundendal itching* and *stitching pains* have been relieved by it in small doses. Large doses have produced these troubles. Dr. Scudder suggests a trial of the drug in "small doses in those cases of chronic disease in which the circulation is feeble, the hands and feet cold and purplish, with fullness of tissues and tendency to œdema" (*Spec. Med.*, 246). Equal parts of the twigs, yellow-dock root, and stillingia made into a syrup, form a valuable preparation for *scrofulous affections*, as well as *syphilitic*. Externally, in the form of ointment, it is employed as a discutient to *painful tumors;* also as an application to some forms of *cutaneous disease*, *ulcers*, and *erysipelatous affections*. Dose of the decoction or syrup, 1 or 2 fluid ounces; of the extract, from 2 to 5 grains; of the powdered leaves, from 10 to 30 grains; specific dulcamara, fraction of a drop to 30 drops. Small doses act best. The decoction is prepared from 1 ounce of fresh twigs and sufficient water to produce, after boiling for 15 minutes, 1 pint of decoction.

Specific Indications and Uses.—Scaly skin affections; acute disorders due to colds and dampness; deficient capillary circulation in the skin; diminished cutaneous action with urinous odor; coldness and blueness of the extremities; full tissues with tendency to œdema.

Related Species.—Several other species of Solanum appear to possess medicinal power —among them are: *Solanum tuberosum*, Linné; *Common potato.* An extract of the herb, *Solanum tuberosum* (common potato), has been found useful in *chronic rheumatic affections, gastric* and *intestinal spasm, cough*, etc., in the dose of from ½ of a grain to 1 grain. Some practitioners have, however, employed it in these affections, and in very large doses, without observing any influence whatever. Probably cultivation, soil, climate, season, etc., exert some influence upon the medicinal powers of the plant. The potato itself has been eaten raw, either with or without vinegar, in cases of *scurvy*, and with good effect; occasionally it has caused narcosis, and slight purgation. Both raw and cooked the potato makes an excellent poultice. Considerable potassium hydroxide may be procured from potato-stalks; and if they be gathered while the plant is in flower, and passed through an oil mill, the juice obtained is said to form a handsome yellow dye. Wackenroder obtained *solanine* from potato sprouts. The green fruits and the herb of the potato plant have also been shown to contain solanine and its allied bases. *solanidine* and *solaneine.* In 1887, Dr. George Kassner demonstrated that weighable quantities of solanine will develop in *injured* potatoes when stored in a cellar (*Amer. Jour. Pharm.*). Traces of mydriatic alkaloids (hyoscyamine, etc.) have even been observed in Solanum tuberosum and allied species.

Lycopersicum esculentum, Millspaugh; (*Solanum Lycopersicum*).—*Tomato*, or *Love-apple*, like the potato, came originally from South America. Its fruit contains several acids (citric, oxalic, and malic acids having been shown to be present), a thick, adhesive, brownish, resinous-like substance, and the seeds probably contain an alkaloid. It is much used as an article of food in the United States, and is supposed to exert a healthy influence upon the liver and biliary organs. The leaves have a heavy, disagreeable odor, and contain oil, extractive, and *solanine*, which has been obtained from all the herbaceous portions of the plant (Kennedy, *Amer. Jour. Pharm.*, 1873). Most of the Solanums are nutritive, or possess medicinal virtues.

Solanum Pseudo-capsicum, Jerusalem cherry.—A handsome, erect, dwarf tree-like shrub, a native of Mauritius, and bearing large scarlet berries. Poisonous. On account of the resemblance of the fruit to cherries, children are liable to be poisoned by them.

Solanum Melongena (or *esculentum*), *Egg-plant.*—This plant yields an elongated, purple fruit known as the *egg-apple, bimjal*, or *aubergine.* It does not possess the agreeable properties of tomato, but when properly prepared is much esteemed as a vegetable.

Solanum nigrum, Linné; *Garden night-shade, Night-shade.*—Solanum nigrum is a fetid, narcotic, bushy herb, with a fibrous root and an erect, branching, angular, herbaceous, thornless stem, 1 or 2 feet in height. Leaves undivided, ovate, toothed, and waved, smooth, lengthened out at the base, almost always with the lamina perforated and the margin erose; as if gnawed by insects. Umbels from the intermediate spaces between the leaves, solitary, peduncled, simple, downy, nodding. Flowers white or pale-violet, with a musky scent; anthers yellow. Berries globose, black, about the size of peas (L.—W.—G.). The *Garden*, or *Black night-shade*, is found growing along old walls, fences, and in gardens, in various parts of the United States, flowering in July and August. Another species, the *Solanum virginianum*, is abundant in this country. It has an erect, prickly stem; pinnatifid leaves, prickly on both sides; divisions sinuate, obtuse; margin ciliate; calyx prickly, and flowers blue, or whitish. The leaves of these plants are the parts employed, and yield their properties to water, alcohol, or fixed oils.

Solanum nigrum is narcotic and sedative, and produces, when given in large doses, sickness and vertigo. One to 3 grains of the leaves infused in water, will, it is said, produce a copious perspiration, and often purge on the next day. They have been used in *cancer, scurvy* and *scrofulous affections*, being applied locally as a cataplasm, or in ointment, and also exhibited in small doses internally. *Solanine*, which was first obtained from this species by Desfosses, in 1820, exists in it more abundantly than in the *S. Dulcamara*, to which it is somewhat analogous in medicinal properties, with more active and energetic narcotic virtues. The berries are poisonous, causing torpor, burning in the stomach, fever, nausea, stupor, and insensibility; though this is denied by M. Dunal, of Montpellier. The plant is employed in the form of ointment only, as a discutient.

Solanum paniculatum, Jerubeba.—Brazil. Considerably used by Brazilian physicians in *anemia, liver disorders, amenorrhœa, vesical catarrh*, and *spleen disorders.* It is regarded tonic, alterative, antiperiodic, antisyphilitic, antiblennorhagic, and drastic. The leaves, fruit, and root are employed both externally and internally. It is considered a good laxative to overcome *chronic constipation. Jerubebine*, an alkaloid, is contained in the root and fruit (F. V. Greene, *Amer. Jour. Pharm.*, 1877, p. 506).

Solanum bacciferum.—A variety of this plant yields the toxic *susumber berries*, from the eating of which several cases of poisoning have been reported. Another variety of the same species is said to be harmless, and its fruit is employed by the natives of Jamaica.

Solanum Jacquinii, Willdenow (*Solanum xanthocarpum*, Schrader).—A drug of considerable repute in India, where it is valued as a diuretic, expectorant, and sialagogue. It is used in Bengal for *dropsy*, and, smoked in a pipe, gives relief in *toothache. Catarrhal fevers, cough*, and *asthma* are among the conditions said to be benefited by it (Dymock, *Mat. Med. Western India*).

Lycium umbrosum, Humboldt and Bonpland. *Nat. Ord.*—Solanaceæ. South America. *Lycium Afrum*, Linné.—North Africa. The leaves of this and the foregoing species are employed in infusion for the relief of numerous *skin affections*, particularly *erysipelas.*

Lycium vulgare, Dunal (*Lycium barbarum*, Linné); *Matrimony vine.*—Indigenous to Mediterranean Europe and is found in the United States, both wild and cultivated. Its flowers are of a dull, purple-green hue. The leaves and bark have a sweet, followed by a faintly bitter, acrid taste. *Lycine* ($C_5H_{11}NO_2$), in deliquescent, white, prismatic crystals, was obtained by Husemann and Marmé, in 1863, from the leaves and branches, the former yielding the larger amount of alkaloid. Its identity with Scheibler's *betaine* (Liebrich's *oxyneurine*), from the juice of beet-root, was subsequently (*Archiv. der Pharm.*, 1875, p. 216) proven by Husemann. According to the latter, it does not pre-exist in the plant, but is developed during the process of obtaining it—*i. e.*, heating in the presence of hydrochloric acid. Alkaloidal mydriatic principles, like those from belladonna, have been detected in this plant by E. Schmidt and others (see *Amer. Jour. Pharm.*, 1890, pp. 13 and 492).

ECHINACEA.—ECHINACEA.

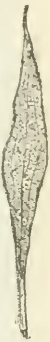
The root of *Echinacea angustifolia*, De Candolle.

Nat. Ord.—Compositæ.

COMMON NAMES: *Narrow-leaved purple cone-flower*, *Purple cone-flower*, *Cone-flower*, *Black sampson.*

Botanical Source.—Echinacea angustifolia is an herbaceous plant, the thick, black, pungent root of which sends up from year to year, a slender, sometimes somewhat stout stem, bristling with hairs, and from 2 to 3 feet high. The leaves (see illustration), which are 3-veined and hispid-pubescent, vary in shape from broad lanceolate to lance-linear. At the base they become slender, and the lowermost have short petioles. The involucre consists of about 2 rows of lanceolate, scaly bracts. As the flower develops the disk is at first concave, but as the growth progresses it becomes ovoid, the receptacle taking on a sharply conical form. The linear-lanceolate, chaff-like bracts of the receptacle are firm, remain permanently attached, are boat-shaped and concave, and become narrowed into a stiff, spine-like crisp, extending beyond the disc-flowers. The ray-flowers are narrow, and from 1 to 2 inches long. They are rose or purple, and drooping or pendant, and, while withering, are yet persistent. They are generally "imperfectly styliferous." Rarely these ray-flowers or ligules are white. The disc-florets are cylindraceous, presenting fine, erect teeth, and the tubular portion upon which the stamens are inserted, is scarcely a tube proper, but merely a ring. The fruit consists of acutely 4-angled akenes (1-seeded, dry, indehiscent pericarps, tipped with the remains of the style), of a firm, tough, yet cork-like texture. They are beset with a thick, crown-like pappus, which is extended somewhat into triangular teeth.

Fig. 101.



Leaf. ⅔ natural size.

History.—Conspicuous among the remedies introduced within recent years, echinacea undoubtedly takes the first rank. As with all new remedies, it has suffered the usual over-estimation, and the exaggerated claims made for it led Prof. Lloyd to view it with suspicion for a long time. Prof. H. T, Webster (*Dynam. Therap.*), was the first to give an extensive, though sectional. account of the therapy of the drug. Though now a well-known drug, echinacea stands peculiarly alone in being essentially a *new* remedy. Many remedies which have lately been introduced can be traced back for years, and some of them for centuries, as having at some time occupied a place in either domestic or professional practice, but our ancient scientific works are silent concerning this species of echinacea. Gray, in his *Synoptical Flora of North America*, published some years ago, wrote: "Used in popular medicine under the name *black sampson*," but since he refers to the plant as "black sampson," a name applied to *Echinacea purpurea*, it may be accepted that he referred to that drug. A careful search through the large number of works upon domestic medicine, herbals, medical botanies, and the so-called "irregular" works upon practice, contained in the Lloyd Library, failed to reveal even a mention of Echinacea angustifolia as a medicinal agent. In this connection, the following from the pen of Mr. C. G. Lloyd, who identified the drug first used by Dr. Meyer and Dr. King, will serve to distinguish between black sampson and Echinacea angustifolia:

"*Echinacea purpurea*, Mœnch, is a plant growing in the eastern states from Pennsylvania west. It was introduced in King's *Dipensatory* under the name of *Rudbeckia purpurea*, and the common name black sampson. *Echinacea angustifolia*, De Candolle, is an entirely different plant, found only in prairie regions, and not occurring east of the prairie regions of Illinois, and has never been used under the name black sampson. There is no mention of it in medical literature preceding the paper of Drs. Meyer and King." The first notices concerning echinacea are from Eclectic physicians, and the drug is, from start to finish, an Eclectic medicine.

Echinacea angustifolia is an indigenous plant of the composite order, growing chiefly in the western states, from Illinois to Nebraska, and southward through Missouri to Texas, thriving best in rich prairie soil. That which grows in marshy places is of inferior quality. It has also been stated that it grows in rocky and sandy soil. The plant, however, which is abundant in Kansas, Nebraska, and neighboring localities, is not mentioned by P. A. Rydberg, in his recently published *Flora of the Sand Hills of Nebraska* (Contributions to the U. S. Nat. Herbarium, Vol. III, No. 3, 1895). The plant blooms from June to August. Echinacea is sometimes known in Kansas as *nigger-head*, a name derived from the shape and somber hue of its fruiting head. The scientific appellations are derived from physical features of the plant, and are therefore descriptive. The generic term *Echinacea*, is derived from the Greek *echinos*, meaning hedge-hog or sea-urchin, referring to the spiny, hedge-hog-like fruiting head; while the specific name *angustifolia*, comes from the two Latin words, *angustus* (narrow) and *folium* (leaf), contrasting thereby this species with the other forms of Echinacea, this being the narrow-leaved species.

The introduction of echinacea into professional practice is due conjointly to Dr. H. F. C. Meyer, of Pawnee City, Neb., and the late Prof. John King. The former had, for many years (since 1870), been using the plant without knowing its botanical position. In a letter to Prof. King (see *E. M. J.*, 1887), in 1886, he communicated to the latter his uses of the drug, as he had employed it for 16 years. His claims for the remedy were based upon the conclusion that it was "an antispasmodic and antidote for blood-poisoning." The enthusiastic doctor had been using it in a secret mixture with wormwood and hops, which he had denominated "Meyer's Blood Purifier." Among his claims for it was its antidotal action upon the poison of various insects, and particularly that of the rattlesnake. Meyer stated that he even allowed a rattler to bite him, after which he bathed the parts with some of the tincture, took a drachm of it internally, and laid down and slept, and upon awakening all traces of swelling had disappeared! Prof. King wrote: "He (Dr. Meyer) kindly offered to send the writer a rattler 8 feet long, that the antidotal influence of the tincture upon dogs, rabbits, etc., bitten by said serpent, might be tested; but having no friendship for the reptile, and being unaccustomed to handling this poisonous ophidian, the generous offer was courteously declined."

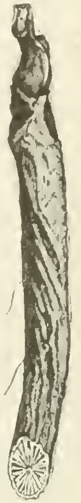
The following range of affections were those in which Dr. Meyer claimed success for this remedy: Malarial fever, cholera morbus, cholera infantum, boils, and internal abscesses, typhoid fever (internally and locally to abdomen); ulcerated sore throat, old ulcers, poisoning from rhus, erysipelas, carbuncles, bites and stings of bees, wasps, spiders, etc.; in nasal and pharyngeal catarrh, hemorrhoids, various fevers, including typhoid, congestive, and remittent; trichinosis, nervous headache, acne, scrofulous ophthalmia, milk crust, scald head, and eczema; also in colic in horses. Subsequent use of the drug has in a measure substantiated the seemingly incredulous claims of its introducer, for it will be observed that most of these conditions were such as might be due to blood depravation, or to noxious introductions from without the body—the very field in which echinacea is known to display its power.

In the autumn of 1885, Dr. Meyer sent to Prof. J. U. Lloyd a quantity of the root, desiring the latter to enlighten him as to its botanical name. At the same time he expressed Dr. King a quantity of the tincture. Prof. Lloyd, questioning the claims of Meyer, wrote to him that he could not name the plant from the root alone, whereupon the latter shipped another quantity of the root, followed (September 28, 1886) by a specimen plant, which Mr. Curtis G. Lloyd then identified as *Echinacea angustifolia* of De Candolle (see paper by Prof. Lloyd on *Echinacea*, in *E. M. Jour.*, Aug., 1897).

Prof. King, appearing to have more faith than Prof. Lloyd in the possibilities of the new drug, took an active interest in it, and by experimenting extensively was soon convinced of its great value. His use of it led him to report success in obstinate naso-pharyngeal catarrh; in rheumatism (one case being of the articular variety); in cholera morbus and cholera infantum; in chronic ulcers of the leg (one case of which was complicated with an eczematous eruption of years' standing); also in painful chronic hemorrhoids, vaginal leucorrhœa with ulceration of the os uteri, poisoning from poison ivy, and stings of wasps and bees, with very extensive swelling. Dyspepsia, with pain and great distress, aggravated by partaking of food, and long resisting treatment, also yielded to it. Goss (*Chicago Medical Times*, 1888), who became interested in the drug, praised it as a remedy for mad dog bites, chronic catarrh, chronic ulcers, gonorrhœa, and syphilis. Dr. A. Parker, of Wilber, Neb., also reported success with it in an apparently hopeless case of septicæmia. Then followed the reports of Dr. Hayes (see below), whose statements did much to obtain general recognition for the drug.

Description, Chemical Composition, and Preparations.—The root of echinacea varies in thickness, from that of an ordinary lead pencil to that of the little finger. The deep-brown or reddish-brown epiderm is shrunken and wrinkled longitudinally, and is often disposed in spiral folds upon the subdermal portion of the root. The woody portion, as seen upon transverse section (see illustration of root), is composed of medullary rays, separated by a greenish, pulp-like substance. When broken the dried root exhibits a grainy and apparently rotten aspect. When chewed the root, if of good quality, imparts at first a sweetish taste, subsequently becoming acrid and pungent, and finally leaving a persistent tingling sensation, followed by a peculiar numbness of the tongue and fauces, seemingly intermediate in character between that produced by aconite and cocaine. It has been compared to the prickling produced by prickly ash, but is essentially different, lacking the peculiar aromatic qualities of the latter.

Fig. 102.



Dried root. ⅔ natural size.

Tincture of echinacea is transparent, and of a reddish-brown color. It mixes well with water, as does also the fluid extract, which gives at first no appreciable precipitation in that fluid. The preparations chiefly employed by Eclectic practitioners, and from which the medicinal value of the agent has been determined, are specific echinacea and ECHAFOLTA. The latter is simply a purified preparation of echinacea, free from coloring matters and extraneous substances, such as chlorophyll, extractive, and other "plant dirt." Much of the root collected has little medicinal value. This is due not to poorly kept and cured roots alone, but chiefly to the locality in which it grows. Much of the drug collected in the marshes and lowlands east of the Mississippi is of this negative quality. The best quality of root comes from the prairie lands of Nebraska (J. U. Lloyd in *E. M. J.*, 1897, p. 427). The experience of the writer is to the effect that few drugs vary more in quality than crude echinacea.

According to Prof. Lloyd, who has made a complete pharmaceutical study of this drug, extending over a period of 13 years (since 1885), the best menstruum for the preparation of either the fluid extract or common tincture of echinacea is a mixture of alcohol 4 parts, and water 1 part. His investigations of echinacea reveal the presence of minute quantities of an alkaloid, which is devoid of color and unimportant so far as its medicinal qualities are concerned. His earlier analyses failed to show the existence of this principle. The characteristic principles of the root are those substances linked to an acid organic body of a resinous character, nearly, if not quite colorless, and possessing, in an exalted degree, the persistently acrid qualities of echinacea—so intensely that it is distressing to the taste, even in very small amount, when pure. The stinging sensation affects the tip of the tongue for hours. But small quantities of it are present, even in the best root—"less than ½ to 1 per cent." (Adapted in part from article by Prof. J. U. Lloyd in *E. M. Jour.*, August, 1897).

Action, Medical Uses, and Dosage.—As a therapeutic agent echinacea is often used both internally and locally at the same time; therefore in this article the internal and external uses will not be given separately, but collectively. And inasmuch as echafolta is a name given to distinguish a purified form of echinacea, the remarks concerning the one are equally applicable to the other, except in important surgical cases, where greater cleanliness is desired, when echafolta is to be preferred.

Under the older classification of remedies, echinacea would probably be classed as an antiseptic and alterative. Strictly speaking, it is practically impossible to classify an agent like echinacea by applying to it one or two words to indicate its virtues. The day is rapidly approaching when these qualifying terms will have no place in medicine, for they but inadequately convey to our minds the therapeutic possibilities of our drugs. Especially is this so with regard to such terms as alterative, stimulant, tonic, etc. If any single statement were to be made concerning the virtues of echinacea, it would read something like this: "A corrector of the depravation of the body fluids," and even this does not sufficiently cover the ground. Its extraordinary powers—combining essentially that formerly included under the terms antiseptic, antifermentative, and antizymotic—are well shown in its power over changes produced in the fluids of the body, whether from internal causes or from external introductions. The changes may be manifested in a disturbed balance of the fluids resulting in such tissue alterations as are exhibited in *boils*, *carbuncles*, *abscesses*, or *cellular glandular inflammations*. They may be from the introduction of serpent or insect venom, or they may be due to such fearful poisons as give rise to *malignant diphtheria*, *cerebro-spinal meningitis*, or *puerperal* and other forms of *septicæmia*. Such changes, whether they be septic or of devitalized morbid accumulations, or alterations in the fluids themselves, appear to have met their antagonist in echinacea. "*Bad blood*," so called, *asthenia*, and *adynamia*, and particularly a *tendency to malignancy* in acute and subacute disorders, seem to be special indicators for the use of echinacea.

Outside of the claims made for this remedy by its introducer, which included many of the conditions for which it is now valued, it first attracted general notice as a remedy for *septicæmia*, in which malady it appeared to promise more than any remedy previously in use. The reports of Dr. Hayes (*E. M. J.*, 1888, pp. 68, 142) gave an impetus to the use of the drug in this direction; since which time physicians, whose statements are valued, have lauded it as a remedy in various forms of blood-poisoning. Thus it has been successfully employed in *injuries* complicated with septic infection. A crushed hand, thought to be beyond aid, with the intolerable stench of putrid flesh, was saved by the application of echinacea. It has given equally satisfactory results in alarming cases of *venom infection*, with great depression, from the *bites of the rattlesnake*, *tarantula* and other *spiders*, and from the *stings of scorpions*, *bees*, *wasps*, etc. Prof. Webster, among others, speaks highly of its action in slow forms of *cerebro-spinal meningitis*, using it as the basic remedy (in connection with other indicated drugs), because of its sedative virtues, controlling, as he believes, the vascular area concerned in the nutrition of the cerebro-spinal meninges, and for its effects upon the general circulation. The cases benefited were those characterized by a slow, feeble pulse, or at least a pulse not appreciably quickened, with the temperature scarcely elevated, and cold extremities. The evidences of cerebral disturbances were erratic. Headache, with a peculiar periodical flushing of the face, even to the neck, was present, and associated with these symptoms, dizziness and profound prostration. Prof. Webster was the first, we believe, to employ the remedy in this affection. He asserts that as a stimulant to the capillary circulation, no remedy is comparable with it, and that it endows the vessels with a recuperative power or formative force, so as to enable them to successfully resist local inflammatory processes due to debility and blood depravation.

While clinical evidence is strong in support of the curative action of echinacea in *diphtheria*, the writer can not but feel that in some instances, at least, the reports have been based upon mistaken diagnoses, and upon non-malignant cases. He is forced to this view from a liberal use of the drug in several cases of a malignant type, in which it utterly failed to accomplish the results desired. Non-malignant forms of diphtheria tend to recovery, and we should be careful about endorsing remedies as curatives in such cases, lest we bring discredit upon a good remedy by making sweeping claims for it which can not be substantiated when the drug is put to a test in the severer forms of the disease. Nevertheless, in these non-malignant cases it appears to expedite convalescence.

In the various forms of *tonsilitis* it has given better results, particularly in the necrotic form, with dirty-looking ulcerative surfaces. It comes well endorsed as a remedy for that malignant form of *quinsy* known in some of the western states as "*black tongue*." Echinacea will contribute much to the cure of various *catarrhal affections of the nose*, *naso-pharynx*, and other portions of the *respiratory tract*.

It is specially indicated by ulcerated and fetid mucous surfaces, with dusky or dark coloration, and a general debilitated habit. Many patients who have taken echinacea for other purposes have remarked its beneficial effects upon *catarrh*, from which they were suffering at the same time. *Chronic catarrhal bronchitis* and *fetid bronchitis* have been signally benefited by echinacea, and it has done that which few remedies can accomplish, *i. e.*, it has overcome the stench of *pulmonary gangrene*, and, if given early, it is asserted to avert a gangrenous termination in pulmonic affections. A case of *typhoid pneumonia* reported by Shelley (*Med. Gleaner*, 1894) with a "jet-black coating of the tongue," evidencing sepsis, improved rapidly under echinacea, in about 2-drop doses every 3 hours.

Echinacea is a good appetizer, and improves digestion. The writer has used it with good results in *fermentative dyspepsia*, with offensive breath and gastric pain as prominent symptoms, which was also aggravated upon taking food. It is also efficient in *duodenal catarrh*, and other forms of *intestinal indigestion*, with pain and debility. Few remedies are as efficient in *ulcerative stomatitis*, and in *nursing sore-mouth* it is asserted to be promptly curative. It has been praised in *diarrhœa*, *cholera morbus*, *cholera infantum*, and *dysentery*, all of the semi-inflammatory type, with a tendency to malignancy. Applied externally and given internally, it has been of service in aborting *typhlitis* and *perityphlitis*.

Echinacea has been prominently mentioned as a remedy for *fevers*. In the *eruptive fevers*, as *measles*, *chicken-pox*, and *scarlet fever*, it has received some praise, especially for its control over the catarrhal phases of the former, and its influence in masking the odor and controlling the pain of the scarlatinal angina. The fevers, however, in which it has accomplished the best results are of the *typhoid* and *typho-malarial types*, as well as in *sympathetic fevers* from septic infection and rheumatic attacks. Notwithstanding that it has been recommended as one of the best antimalarial remedies, it appears to exert but little influence over periodicity. Prof. King reported signal failure in every case of *ague* in which he gave it a trial. Others, however, speak of it as a remedy for *malaria* when of an asthenic character. Possibly in such conditions it might prove of value, as the fevers in which it has proved so successful have been chiefly characterized by adynamia. Very likely its usefulness here depends more upon its influence over the asthenia than upon the miasmatic poison. However, Dr. Snyder, of Cameron, Mo., a good authority, contends that it is an excellent remedy for *chronic malaria*, a personal use of it having first convinced him of its value. The doctor has not, however, given us the special cases to which it is adapted. *Epidemic influenza* (*la grippe*) is occasionally ameliorated by echinacea, and in all such cases, with great debility, it assists materially in securing a good convalescence.

Puerperal fever, due to septicæmia, yields somewhat to echinacea with potassium chlorate and other indicated remedies; yet, in some cases it is inadequate to check the disease unless a thorough curetting of the womb, to insure against the absorption of imprisoned fragments of placenta or unhealthy discharges, be first resorted to. Frequently this procedure alone, with a free use of hydrogen dioxide solution as a douche, is sufficient to cure, but a marked debility often persists. It is this debility that is so pronouncedly benefited by echinacea, and in two instances the writer has thought that the high temperature was averted, and the weakened system greatly sustained, by the liberal use of echinacea, until curetting had been accomplished. Others have been more fortunate in the use of the drug, giving it the credit of being the main agent in accomplishing cures. Its internal and local use is recommended. Hayes commends it in "*mountain fever*," an affection often mistaken for typhoid fever.

Echinacea is in some respects a remedy for *pain*. It relieves the pain of *erysipelas*, and contributes largely to a resolution of the swelling when extensive, tense, and of a purplish-red hue. It is reported to have relieved the pain of *cancerous growths*, particularly when involving the mucous membranes, *as cancer of the fauces*. Prof. Farnum calls attention to the wonderful rapidity with which the odor of carcinoma is overcome by echafolta. He strongly recommends it as an application for cancer, and relates a case of *mammary cancer* long held in check by it. He also advises its internal administration in *cancerous cachexia*. So great is the confidence placed in this agent by our foremost surgeons that they have been content to use it with sterilized water to cleanse and dress, after operations, discharging *tubercular abscesses*, *gangrene*, *empyema with gangrene of the lung*, *appendicitis*, and *carcinoma of the breast* and *testicle* (Farnum). Prof. L. E. Russell advises echafolta as a preventative of sepsis, giving it internally previously to operations, to act as an intestinal antiseptic, and, locally, as a corrective, to dress any traumatism showing signs of sepsis, and as a wash in abdominal and pelvic operations into which any organ has discharged septic contents. *Phlegmonous swellings*, *old sores*, *erysipelas* with sloughing phagedena, *dissecting* or *surgical wounds*, *phlegmasia dolens*, *dermatitis venenata*, and *pus cavities* should be treated with echinacea or echafolta, both locally and internally. A most remarkable case came under the writer's care in which a high fever with marked adynamia, associated with the development of cellular abscesses and a hemorrhagic diarrhœa, yielded to echinacea and Rhus aromatica. Other medicines did but little good until these remedies were brought into use. The abscesses were of a non-active variety, somewhat painful, but not excessively so; they numbered about 10 or 12 at any given time in various parts of the body. The alvine discharges were passed involuntarily, except when kept under control by the fragrant sumach. The boy, whose age was but 4 years, lingered in this condition for over 2 months. Echinacea surely kept the child alive, for whenever the dose, which was 10 drops every 3 hours, was lessened, the symptoms were greatly exaggerated. In spite of his low condition and the very unsanitary surroundings, recovery took place rapidly, as soon as the active symptoms subsided.

Echinacea is highly endorsed as a topical dressing for *malignant carbuncle*. *Painful mammitis* has been very successfully treated with it, and, used as an injection, it relieves the pain and inflammation in *gonorrhœa*. Several physicians have used it in *syphilis*, and declare it a good remedy for that disease, but this seems like claiming too much. It is, however, like thuja, efficient in allaying the pain and healing the *ulcers*, particularly of the mouth, throat, and tongue, affecting syphilitics. Dr. Snyder extols echinacea as an efficient remedy for *impotence*. It acts admirably in *purulent salpingitis*, contributing toward a cure and allaying the distressing pain. Evidence is abundant, concerning its value in *leucorrhœa*, with offensive discharges; and Webster reports it as valuable in *erythematous* or *erysipelatous vulvitis*, being especially effective in that form affecting strumous children. Echinacea is a remedy for *eczema*. It is adapted to chronic cases with sticky or glutinous exudations associated with asthenia and general depravity. Liberal doses should be administered for a prolonged period. A striking malady, which had been diagnosed as *psoriasis*, resulting from vaccination, came under the care of Prof. Ellingwood, of Chicago. A shedding of the hair and a diffuse skin disease, with loss of the nails and thick skin from the palms and soles ensued, followed by a destructive iritis of the left eye and corneal ulcer of the right eye. Prospects were fair for a fatal termination. Perfect recovery, with the exception of the loss of the left eye, followed the use of liberal doses of echinacea, together with syrup of iodide of iron and phospho-albumen.

Dropsy after scarlatina is said to have been cured by echafolta. As this condition usually tends to a spontaneous cure it is difficult to determine how much any remedy contributes to such a result. Likewise echinacea has been recommended to prevent (!) *hydrophobia*. How one can prevent a result of this kind from a dog bite, and especially as the very existence of that so-called disease is denied by many, is not clear. Like many other new remedies echinacea has been reported curative in *smallpox*. It appears to have mitigated many of the severer symptoms of *tubercular phthisis*, and renders expectoration easier in "*stone-cutter's*" or "*grinder's*" *consumption*. It would be no great surprise if this remedy should prove effective in impressing a tubercular diathesis, thereby preventing a termination in consumption.

The dose of either specific echinacea or echafolta ranges from 1 to 5 drops; larger doses (even 60 drops) may be employed, but small doses are generally most efficient if frequently repeated. They may be given in water or syrup, or water and glycerin, as: ℞ Echafolta, flʒj to flʒij; water, q. s., fl℥iv. Mix. Sig. Teaspoonful every ½ or 1 hour in acute cases; every 3 or 4 hours in chronic affections. If these preparations are to be dispensed in hot weather, or are to be used in fermentative gastro-intestinal disorders, the substitution of 1 ounce of glycerin for 1 fluid ounce of the water is advisable. For external use both preparations may be employed, though in point of cleanliness echafolta is to be preferred. Solutions of from 1 to 60 per cent strength may be applied by means of a saturated compress every 2 hours, or oftener, if necessity demands.

Specific Indications and Uses.—To correct fluid depravation, "bad blood," tendency to sepsis and malignancy, as in gangrene, sloughing and phagedenic ulcerations, carbuncles, boils, and various forms of septicæmia; foul discharges, with weakness and emaciation; deepened, bluish or purplish coloration of skin or mucous membranes, with a low form of inflammation; dirty-brownish tongue; jet-black tongue; tendency to the formation of multiple cellular abscesses of semi-active character, with marked asthenia. Of especial importance in typhoid, septicæmic and other adynamic fevers, and in malignant carbuncle, pulmonary gangrene, cerebro-spinal meningitis and pyosalpinx. Echafolta is advised as a cleansing wash in surgical operations, and to annul the pain of and to deodorize carcinomata.

Related Species.—*Rudbeckia laciniata*, Linné; *Thimbleweed.* This plant, also known by the names of *Cone-disk sunflower* and *Tall cone-flower*, is a tall, showy, indigenous perennial plant, with a round, glabrous, stem, 3 to 8 feet in height. Leaves alternate, smooth or roughish; lower ones pinnate, with from 5 to 7 cut or 3-lobed leaflets, petiolate; upper ones irregularly 3 to 5-parted; lobes ovate-lanceolate, pointed. Flowers large, terminal; pappus crenate; chaff truncate and downy at the tip. Rays 1 or 2 inches long, oblanceolate, bright-yellow, spreading or drooping. Disk oblong-conical and columnar in fruit, greenish-yellow (G.—W.). This plant grows in various parts of the United States, in damp places, low thickets, edges of swamps and ditches, etc., flowering from July to September. It was introduced into Europe from America and cultivated in Paris early in the seventeenth century (see *Amer. Jour. Pharm.*, 1872, p. 107). The whole herb is recommended to be used. It has not been investigated chemically. It imparts its properties to water. Thimbleweed is a valuable diuretic, tonic, and balsamic. Useful in many *diseases of the urinary organs*, and highly recommended in *strangury, Bright's disease* (?), and wasting or *atrophy of the kidneys.* Dose of the decoction, *ad libitum.*

Echinacea purpurea, Mœnch (*Rudbeckia purpurea*, Linné), variously called *Red sunflower*, *Comb-flower*, or *Purple cone-flower*, has a thick, black root, with branched, sulcate, smooth, or rough stems, 3 to 5 feet in height. Leaves alternate, 4 to 8 inches long, and about $\frac{1}{5}$ as wide, rough, with short, stiff bristles; lower ones broad-ovate, attenuate at base, 5-nerved, veiny, long-petioled, remotely-toothed; cauline ones lanceolate-ovate, acuminate, nearly entire. Heads large, solitary, on long peduncles. Disk thickly beset with the stiff, pointed, brown chaff. Rays from 15 to 20, 2 or 3 inches long, dull-purple, pendulous, bifid. This plant is common to the western prairies and banks, and is found also in the southern states, flowering from July to September. The root is very pungent to the taste, and has been popularly used in medicine under the name of *Black sampson.* It is stated to have been employed with much benefit in *syphilis* (W.—G.). Both of the above plants deserve a full and thorough investigation from the profession. From all that I have been able to learn, the latter plant is equal to stillingia in medicinal efficacy (King).

Bouvardia triphylla, Trompetilla.—Mexico. Stem and small branches an aboriginal remedy for *hydrophobia* (*A. J. P.*, 1874).

Acerates decumbens.—New Mexico. Reputed specific for *snake-bites* (W. J. Wilson, M. D.).

ELASTICA (U. S. P.)—INDIA-RUBBER.

"The prepared milk-juice of various species of *Hevea* (*Nat. Ord.*—Euphorbiaceæ), known in commerce as Para rubber"—(*U. S. P.*).

SYNONYMS: *Caoutchouc, Gum elastic, Gummi elasticum.*

Botanical Source and History.—Caoutchouc, as it exudes from the trees, is a milk-like emulsion, wherein globules of caoutchouc proper are suspended in a gummy solution. It is produced by several plants chiefly of the natural orders, *Euphorbiaceæ*, *Apocynaceæ*, *Urticaceæ*, *Asclepiadaceæ*, and *Artocarpeæ.* The finest quality of rubber, that known as *Para rubber*, comes from the Amazon district, and is produced by the Heveas. The *Hevea guyanensis*, Aublet (*Siphonia elastica*, of Persoon; *Jatropha elastica*, Linné filius) or *Syringe-tree*, of Brazil, furnishes a portion of the species that are official in the *U. S. P.* This tree generally averages about 65 feet in height, with a diameter varying from 30 to 40 inches. Frequently the trunk reaches 40 or 50 feet in height before branching. In collecting rubber, the natives fasten a small, swallow-nest-shaped, glazed dish around the base of the tree by means of clay; then, by means of a hatchet, sever the bark immediately above it, and the milky sap immediately exudes, and is collected in the dish below. Twenty trees yield, daily, about 2 pints, continuing this amount for some months. The most favorable period for extracting it is from April to November, during dry weather; the trees having to be wounded afresh every day. Some allow it to coagulate in a small, square box, but this method requires several days with subsequent slicing and pressure, to remove air and water; and some form it into bottles, tubes, etc., by dipping a mold of clay, fastened to the end of a stick, into the fresh juice, and immediately afterward holding it in thick smoke, produced by the combustion of oleaginous seeds. When the first layer has properly solidified, it is dipped again, and so continued until a sufficient thickness has been obtained. The smoke coagulates the milk, and exposure for some time to the sun hardens it. A small quantity of alum, or the addition of acids or salt solutions, accelerates the coagulation of the milk, while ammonia has a contrary effect, and is useful when the milk is required to be kept for some time in a liquid state.

Other South American grades, more or less inferior to Para caoutchouc are known commercially as *Pernambuco*, *Maranham*, and *Bahia caoutchouc*, and are derived mainly from *Hancornia speciosa*, Gomez, an apocynaceous plant. Very large quantities of rubber are furnished by the *Landolphias*—*L. florida*, Bentham; *L. gummifera*, Lamarck, and *L. owariensis*, all climbing, apocynaceous plants of West Africa; while in East Africa rubber is yielded by *Landolphia Petersiani* and *L. Kirkii*, and various species of *Vahea* in Madagascar. Other plants of the same order yielding *Borneo caoutchouc*, are the *Urceola elastica*, Roxburgh; *Urceola esculenta*, Bentham (*Chavannesia esculenta*, De Candolle), and other species from the Malayan Islands and India. The *Willughbeia edulis*, Roxburgh, and other apocynaceous plants yield the *Chittagong* variety. A kind of rubber is derived from *Urostigma Vogelii*, Miquel (*Nat. Ord.*—Artocarpeæ) of Liberia in West Africa; *Ficus indica*, Linné, and *Ficus religiosa*, Linné, yield an inferior caoutchouc.

The *Ficus elastica*, Roxburgh (*Urostigma elastica*, Miquel), is the chief source of East India caoutchouc, one variety being called *Assam rubber*. It has a trunk from 2 to 2½ feet in diameter, and from 40 to 60 feet high. The leaves are alternate, approximated, 3-foliate, articulate at the top of a long slender stalk, convex below, furrowed above, and swelled at its base; the leaflets are smooth, oval, acute, green above and cinereous beneath. The flowers are monœcious. Calyx 5-cleft. The fruit is oblong, greenish, 3-cornered, broadest at base, tricoccus, each coccus opening with 2 valves. The seed is ovate, brownish, variegated with black, with a thin, brittle testa, and a sweet, nut-like, pleasant kernel. It is frequently cultivated as a hot-house plant.

Ceara rubber is the product of *Manihot Glaziovii*, Mueller, native of the Rio de Janeiro district. This Brazilian species, unlike the others of that country, thrives in dry situations. Good qualities are also obtained from the following South American species: *Hevea brasiliensis*, Mueller; *Hevea discolor*, Mueller, both yielding Para rubber; *Castilloa Markhamiana*, Collins, and *Castilloa elastica*, Cervantes. The export of rubber from the city of Para (at the mouth of the Amazon River), in the year 1893, exceeded 42,000,000 pounds. An instructive, exhaustive, and admirably illustrated article on rubber and its industry in South America, with a long list of rubber-yielding plants, classified according to their botanical and geographical origin, from the pen of Prof. H. H. Rusby, is to be found in the *Druggists' Circular*, 1894, p. 173. This valuable paper is too extensive to permit of condensation in our pages, and we commend the original article to persons interested in the subject. Efforts are being made to cultivate caoutchouc-yielding plants in various parts of the world; the chief difficulty with regard to Hevea, according to Prof. Rusby, seems to lie in the great length of time required (from 12 to 35 years), to bring the tree to a proper condition of productiveness. In Lagos, on the west coast of Africa, *Kickxia Africana*, Bentham (an apocynaceous plant, the seeds of which have become known as an adulterant of strophanthus seeds), is being cultivated with success, over 580,000 pounds having been exported during the first half of the year 1895. This plant has advantages over the *Landolphias* on account of the climbing habits of the latter, which make cultivation difficult (G. M. Beringer, *Amer. Jour. Pharm.*, 1896, p. 212, from *Kew Bulletin*, 1895).

Description.—Caoutchouc is black when coagulated by smoke, but when pure it is in thin, transparent layers, of a pale-yellow color, destitute both of taste and smell. Upon melting and subsequent cooling it remains in a semi-fluid, adhesive state, undergoing very little change for years, if protected from the action of light, but when exposed to the action of diffused daylight, in the air, it gradually absorbs oxygen, and becomes converted into an inelastic, viscid mass, soluble in alcohol. It is described by the Pharmacopœia as follows: "In cakes, balls, or hollow, bottle-shaped pieces, externally brown to brownish-black, internally brownish or of lighter tint; very elastic; insoluble in water, diluted acids, or diluted solutions of alkalies; soluble in chloroform, carbon disulphide, oil of turpentine, benzin, and benzol. When heated to about 125° C. (257° F.), it melts, remaining soft and adhesive after cooling. Odor faint, peculiar; nearly tasteless. When pure, or nearly pure, India rubber floats on water"—(*U. S. P.*). It is insoluble in alcohol, softens and swells up by long boiling in water, but resumes its former state on exposure to the air, and is soluble in pure ether, most fixed and volatile oils, and coal-tar naphtha, the latter and oil of turpentine being technically convenient solvents. Hot alcohol and wood alcohol cause it to soften and swell. An excellent solvent for caoutchouc is a mixture composed of 6 parts of alcohol and 94 parts of sulphide of carbon. Its solutions in ether, oil of turpentine, and coal-tar naphtha, by evaporation, leave the gum in an elastic state, and on this principle water-proof cloth is made; the same is said to be the case with its solution in the oils of lavender, sassafras, and cajuput. The fixed oils, in dissolving it destroy its elasticity. Under exposure to heat, caoutchouc first melts and then distills, yielding a mixture of several oily liquids, all of which, as well as pure caoutchouc itself, are hydrocarbons. Atmospheric air, ammonia, hydrochloric and diluted sulphuric acids, exert no influence upon caoutchouc. Rubber tubing, it is said, may be prevented from becoming brittle by keeping it under water, which must be changed from time to time.

Chemical Composition.—India rubber is a hydrocarbon having the general formula $(C_{10}H_{16})_x$. It is therefore, to be considered a polymer of terpene $(C_{10}H_{16})$. Upon destructive distillation it yields oily substances, collectively called *oil of caoutchouc* (*caoutchoucin*), besides carbonic acid, carbon monoxide, hydrochloric acid, etc. This oil, when subjected to fractional distillation, may be separated into two fractions, one of low and the other of high boiling points. From the former, a hydrocarbon, *isopren* (C_5H_8), was isolated by Greville Williams (1860), having a specific gravity of 0.622, and a boiling point of 37° C. (98.6° F.). Bouchardat (1875) succeeded in obtaining from this oil, by polymerization, oils of higher boiling point, and the composition $C_{10}H_{16}$; and he even succeeded in obtaining artificial caoutchouc from *isopren*, which he therefore considers to be its basic principle. From the high boiling fraction Himly (Liebig's *Annal.*, Vol. XXVII, p. 40), isolated the hydrocarbon *caoutchin* $(C_{10}H_{16})$, which has a specific gravity of 0.654, and boils at 171° C. (339.8° F.). For a description of substances further evolved from India rubber, see Husemann and Hilger, *Pflanzenstoffe*, p. 511

Caoutchoucin, or *oil of caoutchouc*, is said to be the lightest fluid known, and yet its vapor is denser than the heaviest of the gases. Mixed with alcohol, caoutchoucin dissolves all the resins, especially copal and India rubber, at ordinary temperatures, and it speedily evaporates, leaving them again in the solid state. It mixes with oils in all proportions, and but for its price would be valuable for the solution of resins in the manufacture of varnishes, and to replace turpentines for liquefying oil paints. Being very volatile it must be kept in closed vessels.

VULCANIZED INDIA RUBBER.—When caoutchouc in sheet-form is immersed in a bath of fused sulphur, heated to 121.1° C. (250° F.), it gradually takes up from 12 to 15 per cent of its weight of sulphur, but without undergoing any change in its chemical or physical properties; but if it be then heated for a few minutes to about 150° C. (302° F.), it produces the elastic *vulcanized India rubber*. The same vulcanized condition can also be produced either by kneading the India rubber with sulphur, and then exposing it to the necessary temperature; or by dissolving the India rubber in any known solvent, as turpentine, previously charged with sulphur. It may also be effected by immersing very thin sheets of caoutchouc in a solution of 1 part of chloride of sulphur in 60 parts of bisulphide of carbon; then simple exposure to the air causes it to take the character of vulcanized caoutchouc without the aid of heat. Thus treated, caoutchouc remains elastic at all moderate temperatures; in its ordinary state it is quite rigid at a temperature of 4.4° C. (40° F.); it is not affected by heat short of the vulcanizing point, and acquires extraordinary powers of resisting compression. It does not readily undergo solution in naphtha or turpentine; the sulphur gradually destroys its elasticity, rendering it brittle and subject to decay.

VULCANITE.—If the vulcanized rubber be exposed to a still higher temperature, 148.8° to 176.6° C. (300° to 350° F.), it assumes a carbonized appearance, becomes black, hard, and like horn, and is termed *vulcanite* or *ebonite*, and may be used for most purposes to which horn is adapted. However, it should not come into contact with silver or gold utensils, as the action of the sulphur tarnishes them. Vulcanite becomes negatively electric by friction, is one of the best insulators of electricity known, and appears to resist the action of nearly all solvents. A much higher percentage of sulphur (from 30 to 35 per cent) also enters into the preparation of this hard variety of vulcanized India rubber. For details regarding the manufacture of hard-rubber articles, and the treatment of India rubber in general, we refer the reader to Prof. S. P. Sadtler's most instructive *Handbook of Industrial Organic Chemistry*, 1895.

Action, and Medical and Surgical Uses.—Caoutchouc is employed for a number of purposes, as rubbing out the writing made by lead-pencils; as a cement or lute by chemists and others, being first fused; for forming tubes of various kinds for surgical and other purposes; and it also enters largely into the preparation of waterproof cloth. Innumerable surgical appliances and instruments are made of soft and hard rubber. It is preferred to metal in many instances where a non-corrosive material is desired, and its durability, lightness, firmness and cheapness are in favor of its selection. Tubes—drainage, stomach, and rectal—syringes, specula, catheters, bougies, pessaries, nipple-shields, dilators, truss-pads, artificial nose, ears, and other parts, orthopædic and other surgical appliances are constructed from it. Rubber sheets, bed-pans, and when woven into fabrics, rubber cloth, and stockings, bandages, and other appliances for even compression, hot-water bags, etc., are among the many useful articles of which it forms the whole or a part. Indeed, its peculiar character has rendered it useful in various and numerous ways in the arts, sciences, and for domestic purposes. Softened by heat, it has been applied over small bleeding orifices to check further *hemorrhage;* also to arrest *toothache*, by placing some of it in the abnormal cavity so as to protect the dental nerve from atmospheric action. Externally, it has been used as an ingredient of adhesive plasters and liniments. Caoutchouc dissolved in oil of origanum or cajuput, and spread upon oil-silk or cloth, and allowed to dry, forms an excellent stimulating plaster for many local difficulties. Skin diseases, as *eczema*, *psoriasis*, etc., and *burns* and ill-conditioned *ulcers* have been treated by wearing next to the skin thin sheets of rubber or rubber cloth, which prevents the escape of the perspiration, thus rendering the parts moist and soft. Its use in these conditions is not commendable. *Swelled testicles* have been strapped and compressed by thin bands of caoutchouc, and for even compression and support the rubber stocking and other woven-rubber fabrics are extensively used in *varicosities*, *hydrocele*, *varicocele*, *ventral herniæ*, *pendulous abdomen*, *prolapse of the rectum* and other similar conditions. A grain or 2 of caoutchouc has been administered in *consumption*, repeating it 3 times a day, but its results have not been such as to bring it into general use. It is seldom or never employed internally, and certainly has nothing to recommend it in a medical sense.

Related Preparations.—MARINE GLUE, or CEMENT, is made by digesting from 2 to 4 parts of caoutchouc, cut into small pieces, in 34 parts of coal-tar naphtha, promoting solution by the application of heat, and by agitation. When the solution has the consistence of thick cream, add 62 or 64 parts of powdered shellac, and heat the mixture slowly, constantly stirring it, until complete fusion and combination have been affected. Pour the mixture while still hot on plates of metal, so that it may cool in thin sheets like leather. In using the cement put some of it into an iron vessel, and heat it to about 120° C. (248° F.), and apply it with a brush to the surfaces to be joined.

MINERAL CAOUTCHOUC.—An undetermined substance, differing from petroleum products, and found in deposits a foot or less in depth in Australia, has been named *mineral caoutchouc*, from its marked resemblance to caoutchouc. Whether it is of animal or mineral origin is at present undetermined.

ARTIFICIAL CAOUTCHOUC is an elastic body produced by acting upon a solution of glue with sodium tungstate and hydrochloric acid. The precipitate formed upon the addition of the latter is highly elastic at 29.5° to 40.5° C. (85° to 105° F.), and becomes solid and brittle upon cooling. The process was discovered, in 1871, by Prof. Sonnenschein (*Amer. Jour. Pharm.*, 1871, p. 471).

ELATERINUM (U. S. P.)—ELATERIN.

FORMULA: $C_{20}H_{28}O_5$. MOLECULAR WEIGHT: 347.20.

"A neutral principle obtained from elaterium, a substance deposited by the juice of the fruit of *Ecballium Elaterium* (Linne), A. Richard (*Nat. Ord.*—Cucurbitaceæ)"—(*U. S. P.*).

Preparation.—*Elaterinum* is the principle on which the active properties of elaterium depend. It was first obtained by Morries. Hennel procured it by separating the green resin (chlorophyll) from the crystalline matter of the alcoholic extract of elaterium (see *Elaterium*), by ether, which took up the resin and left the elaterin. The latter was then purified by solution in hot alcohol and subsequent crystallization.

According to Flückiger (*Pharmacographia*), the best method of obtaining elaterin is to exhaust elaterium by means of chloroform; treat the solution so obtained with ether, upon which white crystals of elaterin at once separate. Wash with a small quantity of ether, and recrystallize the pure elaterin from chloroform. This process has been adopted by the *British Pharmacopœia*. Good elaterium should yield from 20 to 25 per cent of elaterin. Less is obtained as the fruit approaches maturity. As high as 50 per cent has been isolated (Walz).

Description and Tests.—Pure elaterin, as officially described, occurs in "minute, white, hexagonal scales, or prismatic crystals, without odor, and having a slightly acrid, bitter taste; permanent in the air. Soluble, at 15° C. (59° F.), in 4250 parts of water, and in 337 parts of alcohol; in 1820 parts of boiling water, and in 34 parts of boiling alcohol; also soluble in 543 parts of ether, or in 2.4 parts of chloroform. At 190° C. (374° F.) the crystals begin to agglutinate, and at about 209° C. (408.2° F.) they melt, forming a yellowish-brown liquid. When ignited, they are consumed without leaving a residue. Elaterin is neutral to litmus paper. Elaterin is dissolved by solutions of the alkalies, and reprecipitated on supersaturating with an acid. When dissolved in cold, concentrated sulphuric acid, it causes the latter to become yellow at first, which color gradually changes to scarlet. On dissolving some crystals of elaterin in melted carbolic acid, and then adding a few drops of strong sulphuric acid, a crimson color will be developed, which soon becomes scarlet. An alcoholic solution of elaterin should not be precipitated by tannic acid T.S., mercuric chloride T.S., or platinic chloride T.S. (absence of, and difference from, alkaloids)"—(*U. S. P.*). Elaterin is possessed of all the activity of elaterium, being considerably stronger and always more definite in strength and quality. Its alcoholic solution is the most active preparation.

Action, Medical Uses, and Dosage.—(See *Elaterium.*) The dose of elaterin is from $\frac{1}{30}$ to $\frac{1}{8}$ grain, the latter being a rather large dose. Not more than $\frac{1}{20}$ to $\frac{1}{25}$ grain should be administered as a beginning dose.

ELATERIUM.—ELATERIUM.

The feculence of the juice of the fruit of *Ecballium Elaterium* (Linné), A. Richard. (*Ecballium officinale*, Nees; *Ecballium agreste*, Reichenbach; *Momordica Elaterium*, Linne; *Elaterium cordifolium*, Mœnch).

Nat. Ord.—Cucurbitaceæ.

COMMON NAMES AND SYNONYMS (of plant producing it): *Squirting cucumber*, *Wild cucumber*, *Wild balsam-apple*, *Cucumis agrestis*, *Cucumis asininus*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 115.

Botanical Source.—The wild, or squirting cucumber, sometimes called wild balsam-apple, is a hispid, scabrous, and glaucous plant. The stems number several from the same root, and are cylindrical, prostrate, and without tendrils. The leaves are cordate, somewhat lobed, crenate-toothed, very rugose, supported on long stalks. The flowers are monœcious and yellow. Male flowers: corolla 5-parted; calyx 5-cleft, with a short tube; stamens triadelphous, with yellow, connate anthers. Female flowers: filaments 3, sterile; style trifid; ovary 3-celled. The fruit is oblong, obtuse at each end, hispid, disarticulating from its stalk with violence, expelling its seeds and mucus with considerable force, in consequence of the sudden contraction of the sides. The seeds are black, compressed, and reticulated (L.).

History and Preparation.—The wild cucumber produces the *Ecballii Fructus* of the *British Pharmacopœia.* It is indigenous to the south of Europe, growing on poor soils, in waste places, and flowering in July. It has been extensively cultivated in England for medicinal purposes, where, however, it dies in the winter. It could be cultivated in our country, as it thrives well, requiring but little attention. The medicinal part is obtained by sedimentation from the juice of the pulp, and forms the *Elaterium* of commerce. The process of the *British Pharmacopœia* for preparing it is essentially as follows: Slice nearly ripe wild cucumbers, express the juice gently, and pass it through a fine hair sieve; then set it aside for some hours until the thicker part has subsided. Reject the thinner, supernatant liquid, transfer the greenish sediment to a linen strainer, allow it to drain, and then, by means of a gentle heat, dry it on a porous brick. Elaterium exists in the juice of the fruit in a soluble condition, but rapidly becomes insoluble when the juice is exposed to the air. Elaterium is seldom adulterated, its variation in strength being due both to the difference in the time of its collection, and to faulty modes of preparation. Sometimes it is obtained by subjecting the pulp to too strong pressure, and in other instances, perhaps, by evaporating the juice to an extract. It is then called *Elaterium nigrum,* as against *Elaterium album,* which is made by the method herein described.

Description.—Good elaterium is in light, brittle, flat flakes, about ½ line or 1 line in thickness, of a pale-gray color, with a slight greenish or yellowish tinge, having a feeble animal odor (slightly tea-like—*Pharmacographia*), and an intensely bitter, somewhat acrid taste. It frequently carries the marks of the muslin or paper containing it during its desiccation. It floats upon water, forms a green tincture with alcohol, and does not effervesce in diluted hydrochloric acid. Rectified spirit dissolves about half its weight, and such a solution concentrated and added to a warm caustic potash solution should yield a deposit of at least 20 per cent of colorless, crystalline elaterin (*Brit. Pharm.*). Elaterium of inferior quality is more or less curled, much darker colored, less brittle, and has a glistening fracture. It yields about 6 per cent of elaterin, while good elaterium yields from 15 to 25 per cent. When obtained from the fruit collected in summer, elaterium may contain from 40 to 50 per cent elaterin. The *Maltese elaterium* is in larger flakes than the best English, is paler, with hardly a trace of green, is soft and friable, or chalky to the touch, and frequently contains starch, chalk, and other impurities. It is inodorous, heavier than water, and effervesces with diluted hydrochloric acid.

Chemical Composition.—Mr. Hennel obtained from elaterium 44 parts of elaterin, 17 parts of green resin, 6 of starch, 7 of saline matters, and 26 of woody fiber (P.). Pectin, gummy substances, and albumen have also been found in it. Its watery solution should be wholly or nearly free from starch, as shown by its behavior to iodine solution. Its most important constituent is the drastic principle *elaterin* ($C_{20}H_{28}O_5$) (see *Elaterinum*). From the whole plant, including the root, four principles, said to be found also in elaterium, were detected by Walz in 1859. They are the yellow, crystallizable glucosid, *prophetin* (found also in the fruit of *Cucumis prophetarum,* Linné); *ecballin* (*ecballic acid*), a bitter, acrid, amorphous, resin-like body; amorphous, non-bitter *hydro-elaterin;* and an extremely bitter, amorphous body, *elaterid.* For a more detailed account of these substances see Husemann and Hilger, *Pflanzenstoffe,* p. 1353.

Action, Medical Uses, and Dosage.—Elaterium is an energetic hydragogue cathartic, operating with great violence in doses of a few grains, causing diffuse inflammation of the stomach and bowels, characterized by vomiting, griping pain, and profuse diarrhœa. It is the most powerful of our hydragogue purgatives, and for this purpose should be used only in plethoric states. In ordinary medicinal doses it produces copious watery evacuations, attended with considerable depression of the circulation and nervous system, and most generally nausea and vomiting. Hence, it is often used in *dropsy,* especially *pulmonary œdema* and *ascites,* to aid in removing the effused fluid, as a revulsive in *cerebral affections,* and wherever a hydragogue or revellent effect is indicated. It has been used in this manner in *narcotic poisoning.* It causes an enormous flow of watery serum from the blood and mucous structures, and it has been aptly said that one may be "bled through the tissues" with a full dose of elaterium. It also augments the urinary discharge. The dose of the common commercial article, as a cathartic, is from $\frac{1}{4}$ to $\frac{1}{2}$ grain, administered every 1 or 2 hours until it operates; of Clutterbuck's elaterium, considered the best, and so named because it is prepared after the process recommended by Clutterbuck, from $\frac{1}{8}$ to $\frac{1}{16}$ of a grain every 3 or 4 hours; of *elaterin*, from $\frac{1}{40}$ to $\frac{1}{12}$ of a grain, best given in form of tincture. A few grains of capsicum added to each dose of elaterium will prevent its nauseating effects. Morris recommends a tincture of elaterin made by dissolving 1 grain in 1 fluid ounce of alcohol, to which 4 drops of nitric acid have been added, the dose is from 20 to 40 drops diluted with cinnamon water. Great care should be exercised in administering elaterium to the debilitated, or to old and infirm individuals, and it is always contraindicated by gastro-intestinal inflammation. Prof. Locke recommends the following: In *dropsy with liver complications*, R Elaterium, gr.j; podophyllin, grs. ij; powd. ext. colocynth comp., grs. xvj; ext. hyoscyamus, q. s. to make a pill mass. Mix. Divide into 8 pills. Give 1 pill every 3 hours until the bowels are freely moved. In *dropsy with heart complications*, R Elaterium, gr.j; powd. digitalis, ʒss; powd. squill, ʒss; ext. hyoscyamus, q. s. to make a pill mass. Mix. Divide into 20 pills. Give 1 or 2 pills every 3 hours until the bowels move freely; after that 1 or 2 pills each day. For *uræmic convulsions with ascites*, particularly that following *scarlatina*, R Elaterium, gr.j; powd. ext. colocynth comp., grs. xv. Mix. Divide into 8 pills. Administer 1 pill every hour until free evacuations are produced (*Syllabus of Ec. Mat. Med.*). In the latter condition, gelsemium, jaborandi, or apocynum may be associated with the elaterium treatment if indicated. "For the first time, I now introduce this article to the profession as a specific in *chronic inflammation of the neck of the bladder*, in which disease I have successfully used it for many years. I am not aware of its ever having been named heretofore for this purpose. It is more especially useful in cases in which there is a constant, more or less painful sensation in the region of the neck of the bladder, where the urine passes in a torrent as if poured through the urethra, and where, after micturition, there is a violent, cramp-like aching in the parts, often extending over the whole lower pelvic region and thighs. The saturated tincture (elaterium gr.j, alcohol fl℥j), is employed in doses varying from 5 to 30 minims; I usually mix it with simple sarsaparilla or other syrup, so that a teaspoonful of the mixture may be taken at a dose, and be repeated 3 or 4 times a day. It must be used carefully, so that it does not purge, although occasionally cases will be met with in which, if its purgative effect is produced by the first doses, its subsequent influence will be more decided. The dose should be small at first, and be gradually increased, as it can be borne. I have also found some good effects from it in *chronic gastritis* and *chronic inflammation* of other mucous membranes" (John King). It must be remembered that it is the minute dose that allays *gastric irritation.* Sore, tender, and heavy, or dragging sensations in the region of the bladder, or in the whole pelvic or perineal region, and accompanied with tenesmic passage of urine containing an abundance of mucus or muco-pus, are relieved by small doses of elaterium more readily than by any other drug. It should also be remembered that in the administration of elaterium only the smallest dose that will accomplish results should be used, for even small doses are apt to occasion emesis and other unpleasant results that may interfere with a successful treatment.

For *irritable and painful states of the bladder*, the *small* dose is now preferred: R Specific elaterium gtt. v to x to aqua fl℥iv. Dose, a teaspoonful every 2 or 3 hours. The ordinary dose of elaterium is from $\frac{1}{20}$ to $\frac{1}{8}$ grain; of elaterin $\frac{1}{40}$ to $\frac{1}{12}$ grain. It must be remembered that both elaterium and elaterin greatly vary in strength.

Specific Indications and Uses.—Chronic cystitis with "constant, more or less painful sensation in the region of the neck of the bladder, where the urine passes in a torrent as if poured through the urethra, and where, after micturition, there is a violent, cramp-like aching in the parts, often extending over the whole lower pelvic region and thighs" (King); deep soreness or tenderness in bladder, pelvis, or perineum, with tenesmic passage of urine loaded with mucus or muco-pus;

constipation. In cathartic doses: Dropsy of plethora; ascites and pulmonary œdema; cerebral congestion.

Related Species.—*Momordica buchu. Nat. Ord.*—Cucurbitaceæ. Brazil. Resembles squirting cucumber in its properties, though its drastic qualities are said to be harsher (*Brit. Med. Jour.*, 1887).

ELEMI.—ELEMI.

A concrete oleoresin obtained by incisions, the source of which has not been determined, though thought to be from *Canarium commune*, Linné (*Nat. Ord.*—Burseraceæ).

SYNONYMS: *Resina elemi, Gummi elemi, Manila elemi.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 61.

Botanical Source and History.—Several resinous bodies have at various times been placed in the European market under the name Elemi, all of which are believed to have been the products of plants of the natural order Burseraceæ. The *British Pharmacopœia* recognizes a product from the Philippine Islands known as *Manila elemi*, thought to be derived from the species above named.

Description.—Manila elemi, when recent, occurs in transparent, soft, granular masses, consisting of a solution of solid resin in essential oil. Externally it has a light, canary-yellow color, and, as found in commerce, is largely solidified, presenting an opaque and granular fracture, due to the crystallization of the resin. Chips and other foreign substances are often found in the solid fragments. When wetted with a little alcohol, elemi readily disintegrates, showing a multitude of small, crystalline needles. It melts easily, a transparent fluid resulting. It has an aromatic, warm, acrid taste, and a fragrant odor, resembling that of the terebinthinates, the drug in many respects closely resembling the latter class of substances. It is insoluble in water, partly soluble in cold, and completely soluble in hot alcohol; easily soluble also in oil of turpentine and ether.

Chemical Composition.—A neutral volatile oil, strongly dextrogyrate, colorless, and fragrant, was obtained to the extent of at least 10 per cent by the authors of *Pharmacographia*. Deville, on the other hand (1841), found oil of elemi to be lævogyre. Maujean (1821) found in this drug two resinous bodies—one soluble in cold spirit, the other in hot spirit only. The principal constituent of the drug is the part soluble in cold alcohol. It is an amorphous, non-acid resin. The part insoluble in this solvent is a crystalline magma, soluble in hot alcohol, which, upon cooling, yields 25 per cent (of the original elemi) of a crystallizable resin, called *amyrin* by Baup (1851). It is also soluble in ether, chloroform, and carbon disulphide. Ciamician, in 1878, distilled it from zinc dust, obtaining *toluene*, *methyl-ethyl-benzene*, and *ethyl-naphthalene*. Vesterberg (1887) differentiated amyrin into two isomers of the formula $C_{30}H_{48}.H_2O$, derived from two isomeric hydrocarbons ($C_{30}H_{48}$) of the melting points 135° C. (275° F.) and 194° C. (381.2° F.). Buri (1874), from the mother-liquors of *amyrin*, obtained a small quantity of an acid, which he called *elemic acid* ($C_{35}H_{46}O_4$). It forms large crystals, melts at 150° C. (302° F.), is insoluble in water, soluble in alcohol, ether, and amyl alcohol. *Bryoïdin* is a crystallizable, neutral substance, observed by Baup in the residual aqueous liquid obtained by the distillation of a mixture of water and the essential oil. It is soluble in hot water and crystallizes upon cooling. Flückiger purified it by sublimation in a current of carbonic acid and found its composition to be $(C_{10}H_{16})_2.3H_2O$, and its melting point 133.5° C. (271.5° F.). Dry hydrochloric acid gas causes bryoïdin to undergo changes of color ranging from red to violet, blue and green. Amyrin remains unchanged under similar treatment. A *bitter principle*, already observed by Bonastre (1824) was obtained by Flückiger in the mother liquors of bryoïdin, in the form of a soft, resinous mass (Flückiger, *Pharmacognosie*, 1891).

Action, Medical Uses, and Dosage.—This agent closely resembles the turpentines, and undoubtedly might be substituted for them. The action of its oil and oil of turpentine are also similar. Elemi is, however, only used in European medicine externally, in plaster and ointment form, as a dressing for *burns*, *indolent sores*, etc.

Related Products.—BRAZILIAN ELEMI. The product of several species of *Icica*. A greenish-yellow, fragrant, translucent resin, sometimes opaque, whitish-gray or yellowish. It is composed of small needles. The odorous resin exuding from the trunks of species of *Icica* (*e. g.*, *I. Icicariba*, De Candolle) is consumed as incense in the churches of French Guiana (P. L. Simmonds, *Amer. Jour. Pharm.*, 1895, p. 253).

Mexican Elemi. *Vera Cruz elemi.*—The product of *Amyris elemifera* of Royle; also of *Elaphrium Jacquinianum* (*Bursera tomentosa*) and *E. elemifera* (*Amer. Journ. Pharm*, 1895, p. 253). Occurs in opaque (sometimes translucent) fragments or semi-cylindrical pieces, is pale-yellow or nearly white, and has an agreeable odor. It may be readily masticated. Treatment with cold alcohol reveals white needles, probably of *amyrin*.

Mauritius Elemi. The product of *Colophonia Mauritiana*, De Candolle (Mauritius). When fresh this is a liquid, but subsequently hardens, and finally resembles the Manilla product, especially in the abundance of residual *amyrin* crystals by treatment with cold alcohol.

African Elemi, or Oriental Elemi. *Lubân meyeti, Lubân mati.*—Exudes from *Boswelli Frereana*, Birdwood. Occurs in tears, fragments, or large stalactitic pieces, whose fracture is shell-like, exhibiting a transparent, amber-yellow interior. It is encrusted with a thin, opaque crust. The thin, paper-like, brown bark may be found adhering to the masses. The taste is mildly terebinthinous, while the odor is said to be agreeable, resembling a mixed odor of turpentine and lemon. Alcohol practically dissolves it. It was found to be a mixture of a dextrogyrate terpene ($C_{10}H_{16}$), and a probably lævogyre oxygenated oil (*Pharmacographia*).

Oil of Mexican Lignaloes is yielded by the wood of *Bursera delpachiana*. It has the combined fragrance of lemon and jasmine.

ELIXIRIA.—ELIXIRS.

Definition and History.—The term "Elixir" is an heirloom, and comes to us from the alchemist. Among the alchemical vagaries none stand more conspicuous than the *Elixir Vitæ*. The substance designated in alchemy as an *elixir* may be defined clearly, in the language of Boerhaave, as "An artificial body of such virtue and efficacy as that, being applied to any body of any of the three kingdoms, it shall improve its natural inherent virtues, so as to make it the most perfect thing in its kind. Thus, for instance, if applied to the human body, it will become an universal medicine, and make such a change, both in the solid and fluid parts thereof, as shall render it perfectly sound, and even maintain it in that state, until the parts, being slowly worn away and spent, death gently, and without a struggle, takes possession."

Then came Paracelsus (b. 1493 d. 1541) who is generally accredited with instituting a new era in the study. He demonstrated that alchemy, which flourished in his day, and of which he was a zealous student, could be made of value to the physician. He originated the famous concoction "*Elixir Proprietatis*," made of saffron, aloes, and myrrh, claiming that whoever used it would "live as long as Methuselah;" then he died in his 47th year. Following this came the era of proprietary elixirs, all of them nasty and probably all frauds. Among these we may name *Doffey's Elixir*, *Helmont's Elixir*, *Mynsicht's Elixir*, *Vigani's Elixir*, etc. These naturally were imitated and gave lines of elixirs to the early pharmacopœias. They were first introduced under fanciful names, which spoke of their uses, not of their constituents. They were all very disagreeable and usually bitter, being, in fact, compound tinctures. Finally, the original name became secondary and thus this class of compound tinctures, favorites in medicine until recently, were established. The following list will give the original (elixir) name of a few of these compounds and the resultant compound tincture, as it is still found in our pharmacopœias:

Elixir Salutis gave us *Compound Tincture of Senna.*
Elixir Paregoricum gave us *Camphorated Tincture of Opium.*
Elixir Proprietatis gave us *Compound Tincture of Aloes.*
Elixir Stomachicum gave us *Compound Tincture of Gentian.*
Elixir Sacrum gave us *Tincture of Rhubarb and Aloes.*

Gradually the physician and pharmacist, under the march of civilization, revolted against these villainous concoctions. No aim had been made toward making them palatable; indeed, the contrary seemed evident. The *London New Dispensatory* (1770), however, named one elixir containing sugar. But at present, in European pharmacy and medicine, an elixir is still an alcoholic liquid free from sugar.

In 1859, Mr. Alfred B. Taylor, of Philadelphia, published in the *American Journal of Pharmacy* a formula for a sweetened "*Elixir of Calisaya.*" The *Druggists'*

Circular of the same year states that no previous formula had been published. Immediately manufacturers of pharmaceutical preparations threw lines of sweetened elixirs on the market. These were really cordials. In 1870 to 1874, the elixir mania was at its height. In 1871, Prof. J. Faris Moore, M. D., representing the American Pharmaceutical Association, on "*Unofficial Preparations*," included formulæ for several of these popular mixtures. In 1872, Prof. C. Lewis Diehl read a paper on the elixir subject before the Louisville College of Pharmacy, which was published generally. The agitation was continued in the American Pharmaceutical Association, but finally the elixir craze died out, not, however, until a few of its members received recognition in the *U. S. P.* The American Elixir is a cordial, made of sugar, spirit, flavors, and drugs. It is not as disagreeable as the European Elixir and in that regard may be entitled to preference. Eclectic physicians have always opposed elixirs. In the following pages will be found formulæ from the *National Formulary*, for those most important. For more extensive lists the reader is referred to the *National Formulary*, and *Elixirs*, by J. U. Lloyd.

National Formulary Elixirs.—Elixir Ammonii Bromidi (N. F.), *Elixir of ammonium bromide.—Formulary number*, 32: "Ammonium bromide, eighty-five grammes (85 Gm.) [3 oz. av.]; citric acid, four grammes (4 Gm.) [62 grs.]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the ammonium bromide and the citric acid in about five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of aromatic elixir, by agitation. Then add enough aromatic elixir to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and filter, if necessary. Each fluid drachm contains 5 grains of ammonium bromide"—(*Nat. Form.*).

Elixir Ammonii Valerianatis (N. F.), *Elixir of ammonium valerianate.—Formulary number*, 33: "Ammonium valerianate, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; chloroform, eight-tenths of a cubic centimeter (0.8 Cc.) [13 ♏]; tincture of vanilla (*U. S. P.*), sixteen cubic centimeters (16 Cc.) [260 ♏]; compound tincture of cudbear (F. 419), sixteen cubic centimeters (16 Cc.) [260 ♏]; water of ammonia (*U. S. P.*), aromatic elixir (*U. S. P.*), of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the ammonium valerianate in about seventy-five cubic centimeters (75 Cc.) [2 fl℥, 257 ♏] of aromatic elixir, in a graduated vessel, and add enough water of ammonia, in drops, until a faint excess of it is perceptible in the liquid. Then add the chloroform, tincture of vanilla and compound tincture of cudbear, and finally, enough aromatic elixir to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Filter, if necessary. Each fluid drachm contains 2 grains of ammonium valerianate. *Note.*—Should the odor of valerianic acid become perceptible after the elixir has been kept for some time, it may be overcome by slightly supersaturating with water of ammonia"—(*Nat. Form.*).

Elixir Apii Graveolentis Compositum (N. F.), *Compound elixir of celery.—Formulary number*, 36: "Fluid extract of celery seed (F. 139), sixty-two cubic centimeters (62 Cc.) [2 fl℥, 46 ♏]; fluid extract of erythroxylon (*U. S. P.*), sixty-two cubic centimeters (62 Cc.) [2 fl℥, 46 ♏]; fluid extract of kola (F. 175), sixty-two cubic centimeters (62 Cc.) [2 fl℥, 46 ♏]; fluid extract of viburnum prunifolium (*U. S. P.*), sixty-two cubic centimeters (62 Cc.) [2 fl℥, 46 ♏]; alcohol, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; aromatic elixir (*U. S. P.*), a sufficient quantity, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the alcohol with two hundred and fifty cubic centimeters (250 Cc. [8 fl℥, 218 ♏] of aromatic elixir. To this add the fluid extract of celery seed in several portions, shaking after each addition, and afterwards the other fluid extracts. Finally add enough aromatic elixir to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], allow the mixture to stand 24 hours, and filter. *Note.*—If this preparation is prescribed or quoted under its Latin title, it is recommended that the full title be given, so that the word 'Apii' may not be mistaken for 'Opii'"—(*Nat. Form.*).

Elixir Bismuthi (N. F.), *Elixir of bismuth.—Formulary number*, 37: "Bismuth and ammonium citrate, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; water, hot, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; water of ammonia (*U. S. P.*), and aromatic elixir (*U. S. P.*), of each a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the bismuth and ammonium citrate in the hot water, allow the solution to stand until any undissolved matter has subsided; then decant the clear liquid, and add to the residue just enough water of ammonia to dissolve it. Then mix it with the decanted portion and add enough aromatic elixir to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Filter, if necessary. Each fluid drachm represents 2 grains of bismuth and ammonium citrate"—(*Nat. Form.*).

Elixir Buchu (N. F.), *Elixir of buchu.—Formulary number*, 38: "Fluid extract of buchu (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; alcohol, sixty-two cubic centimeters (62 Cc.) [2 fl℥, 46 ♏]; syrup (*U. S. P.*), sixty-two cubic centimeters (62 Cc.) [2 fl℥, 46 ♏]; magnesium carbonate, fifteen grammes (15 Gm.) [231 grs.]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the fluid extract of buchu with the alcohol, then add seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏], of aromatic elixir, and the syrup. Incorporate with it the magnesium carbonate, and filter. Finally, pass enough aromatic elixir through the filter to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents about 7½ grains of buchu"—(*Nat. Form.*).

Elixir Buchu Compositum (N. F.), *Compound elixir of buchu.—Formulary number*, 39: "Compound fluid extract of buchu (F. 144), two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; alcohol, sixty-two cubic centimeters (62 Cc.) [2 fl℥, 46 ♏]; syrup (*U. S. P.*), sixty-two cubic centimeters (62 Cc.) [2 fl℥, 46 ♏]; magnesium carbonate, fifteen grammes (15 Gm.) [231 grs.]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏]. Mix the compound fluid extract of buchu with the alcohol, then add five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of aromatic elixir, and the syrup. Incorporate with it the magnesium carbonate, and filter. Finally, pass enough aromatic elixir through the filter to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents 15 minims of compound fluid extract of buchu"—(*Nat. Form.*).

Elixir Buchu et Potassii Acetatis (N. F.), *Elixir of buchu and potassium acetate.—Formulary number*, 40: "Potassium acetate, eighty-five grammes (85 Gm.) [3 ozs. av.]; elixir of buchu (F. 38), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the potassium acetate in about seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of elixir of buchu; filter, if necessary, and add enough elixir of buchu to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents 5 grains of potassium acetate and about 7 grains of buchu"—(*Nat. Form.*).

Elixir Caffeinæ (N. F.), *Elixir of caffeine.—Formulary number*, 41: "Caffeine, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; diluted hydrobromic acid (*U. S. P.*), four cubic centimeters (4 Cc.) [65 ♏]; syrup of coffee (F. 367), two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Rub the caffeine, in a mortar, with the diluted hydrobromic acid, and about one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏] of aromatic elixir, until solution is effected. Then add the syrup of coffee, and lastly, enough aromatic elixir to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Filter, if necessary. Each fluid drachm contains 1 grain of caffeine"—(*Nat. Form.*).

Elixir Calcii Hypophosphitis (N. F.), *Elixir of calcium hypophosphite.—Formulary number*, 43: "Calcium hypophosphite, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; citric acid, four grammes (4 Gm.) [62 grs.]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the calcium hypophosphite in nine hundred cubic centimeters (900 Cc.) [30 fl℥, 308 ♏] of aromatic elixir, and filter. Dissolve the citric acid in the filtrate, and pass enough aromatic elixir through the filter to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains 2 grains of calcium hypophosphite"—(*Nat. Form.*).

Elixir Calcii Lactophosphatis (N. F.), *Elixir of calcium lactophosphate.—Formulary number*, 44: "Calcium lactate, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; phosphoric acid (*U. S. P.*, 85 per cent), eight cubic centimeters (8 Cc.) [130 ♏]; water, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; syrup (*U. S. P.*), sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the calcium lactate with the phosphoric acid, the water, and the syrup, until the salt is dissolved. Then add enough aromatic elixir to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and filter. Each fluid drachm represents 1 grain of calcium lactate, or about 1½ grains of so-called calcium lactophosphate"—(*Nat. Form.*).

Elixir Catharticum Compositum (N. F.), *Compound cathartic elixir.—Formulary number*, 45: "Fluid extract of senna (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; fluid extract of podophyllum (*U. S. P.*), sixty-two cubic centimeters (62 Cc.) [2 fl℥, 46 ♏]; fluid extract of leptandra (*U. S. P.*), fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; fluid extract of jalap (F. 162), fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; potassium and sodium tartrate, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; sodium bicarbonate, sixteen grammes (16 Gm.) [247 grs.]; compound elixir of taraxacum (F. 111), two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; elixir of glycyrrhiza (F. 76), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the fluid extracts with the compound elixir of taraxacum; in the mixture dissolve the salts by agitation, and add enough elixir of glycyrrhiza to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. The product should not be filtered, and should be shaken up whenever any of it is dispensed. The average dose for an adult is 2 fluid drachms"—(*Nat. Form.*).

Elixir Chloroformi Compositum (N. F.), *Compound elixir of chloroform.—Formulary number*, 46: "Chloroform, one hundred and ninety cubic centimeters (190 Cc.) [6 fl℥, 204 ♏]; tincture of opium (*U. S. P.*), one hundred and ninety cubic centimeters (190 Cc.) [6 fl℥, 204 ♏]; spirit of camphor (*U. S. P.*), one hundred and ninety cubic centimeters (190 Cc.) [6 fl℥, 204 ♏]; aromatic spirit of ammonia (*U. S. P.*), one hundred and ninety cubic centimeters (190 Cc.) [6 fl℥, 204 ♏]; alcohol, two hundred and thirty-five cubic centimeters (235 Cc.) [7 fl℥, 454 ♏]; oil of cinnamon (cassia), five cubic centimeters (5 Cc.) [81 ♏]. Mix the chloroform with the alcohol, then add the oil of cinnamon, aromatic spirit of ammonia, spirit of camphor, and tincture of opium. Allow the mixture to stand a few hours, and filter in a well-covered funnel. Each fluid drachm represents about 1 grain of opium and 11 minims of chloroform. *Note.*—This preparation is called chloroform paregoric in some sections of the country. It is recommended that this title be abandoned, to prevent confusion with the official paregoric or *Tinctura Opii Camphorata*"—(*Nat. Form.*).

Elixir Cinchonæ (N. F.), *Elixir of cinchona, Elixir of calisaya.—Formulary number*, 47: "Tincture of cinchona (*U. S. P.*), one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; syrup (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; glycerin, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; aromatic elixir (*U.S.P.*), six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏]. Mix the liquids, allow to stand as long as convenient, and filter through a wetted filter. Each fluid ounce represents about 14 grains of yellow cinchona"—(*Nat. Form.*).

Elixir Cinchonæ Detannatum (N. F.), *Detannated elixir of cinchona, Detannated elixir of calisaya.—Formulary number*, 48: "Detannated tincture of cinchona (F. 403), one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; syrup (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; glycerin, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; aromatic elixir (*U. S. P.*), six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏]. Mix the liquids, and filter, if necessary. Each fluid ounce represents about fourteen grains (14 grains) of yellow cinchona. *Note.*—This preparation may be used when elixir cinchonæ is directed in combination with preparations of iron, but may be replaced by compound elixir of quinine (F. 98), colored by the addition of fifteen cubic centimeters (15 Cc.) [242 ♏] of compound tincture of cudbear (F. 419) to one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form.*).

Elixir Cinchonæ et Ferri (N. F.), *Elixir of cinchona and iron, Elixir of calisaya and iron, Ferrated elixir of calisaya.—Formulary number*, 50: "Phosphate of iron (*U. S. P.*), thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; water, boiling, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; compound elixir of quinine (F. 98), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the phosphate of iron in the boiling water, then add enough compound elixir of quinine to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and filter. Each fluid drachm contains 2 grains of phosphate of iron"—(*Nat. Form.*).

Elixir Cinchonæ, Ferri et Strychninæ (N. F.), *Elixir of cinchona, iron and strychnine, Elixir of calisaya, iron and strychnine.—Formulary number*, 55: "Strychnine sulphate, one hundred and seventy-five milligrammes (0.175 Gm.) [2.7 grs.]; water, fifteen cubic centimeters (15 Cc.) [242 ♏]; elixir of cinchona and iron (F. 50), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the strychnine sulphate in the water and add enough elixir of cinchona and iron to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains $\frac{1}{100}$ grain of strychnine sulphate, and about 2 grains of phosphate of iron"—(*Nat. Form.*).

Elixir Curassao (N. F.), *Elixir of curaçao, Curaçao cordial.—Formulary number*, 58: "Spirit of curaçao (F. 348), sixteen cubic centimeters (16 Cc.) [260 ♏]; orris root, in fine powder, four grammes (4 Gm.) [62 grs.]; deodorized alcohol, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; citric acid, seven grammes (7 Gm.) [108 grs.]; syrup (*U. S. P.*), five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; magnesium carbonate, fifteen grammes (15 Gm.) [231 grains]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the spirit of curaçao with the alcohol, add the orris root, the magnesium carbonate, and one hundred and eighty-five cubic centimeters (185 Cc.) [6 fl℥, 123 ♏] of water. Allow the mixture to stand 12 hours, occasionally agitating; then pour it on a wetted filter, returning the first portions of the filtrate until it runs through clear, and pass enough water through the filter to make the filtrate measure five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]. In this dissolve the citric acid, and finally add the syrup"—(*Nat. Form.*).

Elixir Erythroxyli (N. F.), *Elixir of erythroxylon, Elixir of coca.—Formulary number*, 61: "Fluid extract of erythroxylon (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; alcohol, sixty-two and one-half cubic centimeters (62.5 Cc.) [2 fl℥, 54 ♏]; syrup (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; tincture of vanilla (*U. S. P.*), sixteen cubic centimeters (16 Cc.) [260 ♏]; purified talcum (F. 395), fifteen grammes (15 Gm.) [231 grs.]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the fluid extract with the alcohol, the syrup, and six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of aromatic elixir, add the purified talcum and incorporate the latter thoroughly. Let the mixture stand during 48 hours, if convenient, shaking occasionally; then filter, add the tincture of vanilla to the filtrate, and pass enough aromatic elixir through the filter to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents 7½ grains of erythroxylon (coca)"—(*Nat. Form.*).

Elixir Ferri Hypophosphitis (N. F.), *Elixir of hypophosphite of iron.—Formulary number*, 65: "Solution of hypophosphite of iron (F. 219), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; aromatic elixir (*U. S. P.*), nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏]. Mix, allow the mixture to stand a few days in a cool place, and filter, if necessary. Each fluid drachm contains 1 grain of hypophosphite of iron (ferric)"—(*Nat. Form.*).

Elixir Ferri Phosphatis (N. F.), *Elixir of phosphate of iron.—Formulary number*, 67: "Phosphate of iron (*U. S. P.*), thirty-five grammes (35 Gm.) [1 oz. av., 103 ♏]; water, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the phosphate of iron in the water with the aid of heat; then mix this solution with a sufficient quantity of aromatic elixir to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Filter, if necessary. Each fluid drachm contains 2 grains of phosphate of iron"—(*Nat. Form.*).

Elixir Ferri Phosphatis, Quininæ et Strychninæ (N. F.), *Elixir of phosphate of iron, quinine and strychnine.—Formulary number*, 69: "Phosphate of iron (*U. S. P.*), seventeen and one-half grammes (17.5 Gm.) [270 grs.]; quinine (alkaloid), eight and three-fourths grammes (8.75 Gm.) [135 grs.]; strychnine (alkaloid), two hundred and seventy-five milligrammes (0.275 Gm.) [4.24 grs.]; alcohol, one hundred and thirty cubic centimeters (130 Cc.) [4 fl℥, 190 ♏]; water, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the alkaloids in the alcohol and add seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of aromatic elixir, then dissolve the phosphate of iron in the water, using heat, if necessary, and add to the previous mixture. Finally, add enough aromatic elixir to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains 1 grain of phosphate of iron, ½ grain of quinine, and $\frac{1}{64}$ grain of strychnine. *Note.*—When this elixir is mixed with water, it may become cloudy or opaque through the separation of some of its constituents"—(*Nat. Form.*).

Elixir Ferri Pyrophosphatis (N. F.), *Elixir of pyrophosphate of iron.—Formulary number*, 70: "Pyrophosphate of iron (*U. S. P.*), thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; water, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the pyrophosphate of iron in the water, and add enough aromatic elixir to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Filter, if necessary. Each fluid drachm contains 2 grains of pyrophosphate of iron"—(*Nat. Form.*).

Elixir Ferri, Quininæ et Strychninæ (N. F.), *Elixir of iron, quinine and strychnine.—Formulary number*, 71: "Tincture of citro-chloride of iron (F. 407), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; quinine hydrochlorate, eight and one-half grammes (8.5 Gm.) [131 grs.]; strychnine sulphate, one hundred and seventy-five milligrammes (0.175 Gm.) [2.7 grs.]; alcohol, thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the alkaloidal salts in about seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of aromatic elixir, then add the tincture and the alcohol, and finally, enough aromatic elixir to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Filter, if necessary. Each fluid drachm represents about 1 grain of ferric chloride, ½ grain of quinine hydrochlorate, and $\frac{1}{100}$ grain of strychnine sulphate"—(*Nat. Form.*).

Elixir Frangulæ (N. F.), *Elixir of frangula, Elixir of buckthorn.—Formulary number*, 72: "Fluid extract of frangula (*U. S. P.*), two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; alcohol, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; compound elixir of taraxacum (F. 111), two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; aromatic elixir (*U. S. P.*), four hundred and forty cubic centimeters (440 Cc.) [14 fl℥, 422 ♏]. Mix them, allow the mixture to stand during 48 hours, if convenient, and filter. Each fluid drachm represents 15 grains of frangula"—(*Nat. Form.*).

Elixir Gentianæ (N. F.), *Elixir of gentian.—Formulary number*, 73: "Fluid extract of gentian (*U. S. P.*), thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; compound spirit of cardamom (F. 347), twenty-five cubic centimeters (25 Cc.) [406 ♏]; solution of tersulphate of iron (*U. S. P.*), twenty-five cubic centimeters (25 Cc.) [406 ♏]; water of ammonia (*U. S. P.*), twenty-eight cubic centimeters (28 Cc.) [455 ♏]; alcohol, water, aromatic elixir (*U. S. P.*), of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dilute the solution of tersulphate of iron with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of cold water, and add it, constantly stirring, to the water of ammonia, previously diluted with an equal volume of cold water. Collect the precipitate on a well wetted muslin strainer, allow it to drain completely, return it to the vessel, mix it intimately with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and again drain. Repeat this operation once more with the same quantity of water. When the precipitate has been completely drained for the third time, fold the strainer, and press it gently so as to remove the water as completely as possible without loss of magma; then remove the magma into a tared bottle, and ascertain its weight. Now add to the magma one-fifth (⅕) of its weight of alcohol, the fluid extract, the compound spirit, and seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of aromatic elixir, and shake the mixture occasionally during 24 hours. Filter through paper, and pass enough aromatic elixir through the filter to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents about 2 grains of gentian"—(*Nat. Form.*).

Elixir Gentianæ Cum Tinctura Ferri Chloridi (N. F.), *Elixir of gentian with tincture of chloride of iron.—Formulary number*, 74: "Tincture of citro-chloride of iron (F. 407), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; elixir of gentian (F. 73), nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏]. Mix and filter, if necessary. Each fluid drachm represents about ¾ grain of ferric chloride, and nearly 2 grains of gentian"—(*Nat. Form.*).

Elixir Glycyrrhizæ Aromaticum (N. F.), *Aromatic elixir of glycyrrhiza, Aromatic elixir of liquorice. Formulary number*, 77: "Fluid extract of glycyrrhiza (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; oil of cloves, four-tenths of a cubic centimeter (0.4 Cc.) [6.5 ♏]; oil of cinnamon (Ceylon), four-tenths of a cubic centimeter (0.4 Cc.) [6.5 ♏]; oil of nutmegs, one-fourth of a cubic centimeter (0.25 Cc.) [4 ♏]; oil of fennel, three-fourths of a cubic centimeter (0.75 Cc.) [12 ♏]; magnesium carbonate, fifteen grammes (15 Gm.) [231 grs.]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the oils with magnesium carbonate, and gradually add eight hundred and seventy-five cubic centimeters (875 Cc.) [29 fl℥, 282 ♏] of aromatic elixir. Shake occasionally during an hour, filter, and pass enough aromatic elixir through the filter to make eight hundred and seventy-five cubic centimeters (875 Cc.) [29 fl℥, 282 ♏] of filtrate. Add the fluid extract to the filtrate, mix, and filter, if necessary"—(*Nat. Form.*). Employed to mask the bitterness of quinine.

Elixir Guaranæ (N. F.), *Elixir of guarana.—Formulary number*, 79: "Fluid extract of guarana (*U. S. P.*), two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏]; aromatic elixir (*U. S. P.*), two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏]; compound elixir of taraxacum

(F. 111), six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏]. Mix them; allow the mixture to stand during 48 hours, if convenient, and filter. Each fluid drachm represents about 12 grains of guarana"—(*Nat. Form.*).

Elixir Hypophosphitum (N. F.), *Elixir of hypophosphites.—Formulary number*, 81: "Calcium hypophosphite, fifty-two and one-half grammes (52.5 Gm.) [1 oz. av., 373 grs.]; sodium hypophosphite, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; potassium hypophosphite, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; citric acid, four grammes (4 Gm.) [62 grs.]; water, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; glycerin, thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏]; compound spirit of cardamom (F. 347), thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the hypophosphites and the citric acid in the water; then add the glycerin, compound spirit of cardamom, and enough aromatic elixir to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Filter, if necessary. Each fluid drachm contains 3 grains of calcium hypophosphite and 1 grain each of sodium and potassium hypophosphite"—(*Nat. Form.*).

Elixir Hypophosphitum Cum Ferro (N. F.), *Elixir of hypophosphites with iron.—Formulary number*, 82: "Calcium hypophosphite, twenty-five grammes (25 Gm.) [386 grs.]; sodium hypophosphite, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; potassium hypophosphite, eight and one-half grammes (8.5 Gm.) [131 grs.]; sulphate of iron, in clear crystals, thirteen grammes (13 Gm.) [201 grs.]; citric acid, four grammes (4 Gm.) [62 grs.]; water, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; syrup (*U. S. P.*), two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the hypophosphites in one hundred and seventy-five cubic centimeters (175 Cc.) [5 fl℥, 440 ♏] of water, and add the syrup. Dissolve the sulphate of iron in the remainder of the water, and mix this with the other solution. Then add three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of aromatic elixir, set the mixture aside, in a cold place for 12 hours, and filter from the deposited calcium sulphate. Finally, dissolve the citric acid in the filtrate, and pass enough aromatic elixir through the filter to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains about ½ grain of hypophosphite of iron (ferrous), about 1 grain each, of the hypophosphites of calcium and sodium, and ½ grain of potassium hypophosphite"—(*Nat. Form.*).

Elixir Lithii Citratis (N. F.), *Elixir of lithium citrate.—Formulary number*, 84: "Lithium citrate, eighty-five grammes (85 Gm.) [3 oz. av.]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the lithium citrate in about nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of aromatic elixir, by agitation. Then add enough aromatic elixir to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and filter. Each fluid drachm contains 5 grains of lithium citrate"—(*Nat. Form.*).

Elixir Malti et Ferri (N. F.), *Elixir of malt and iron.—Formulary number*, 86: "Extract of malt, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; phosphate of iron (*U. S. P.*), seventeen and one-half grammes (17.5 Gm.) [270 grs.]; water, thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the phosphate of iron in the water by the aid of heat, mix the solution with the extract of malt previously introduced into a graduated bottle, and add enough aromatic elixir to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Set the mixture aside for 24 hours, and filter. Each fluid drachm represents 1 grain of phosphate of iron, and 15 minims of extract of malt. *Note.*—Extract of malt, most suitable for this preparation, should have about the consistence of Balsam of Peru, at a temperature of about 15° C. (59° F.)"—(*Nat. Form.*).

Elixir Pepsini (N. F.), *Elixir of pepsin.—Formulary number*, 88: "Pepsin (*U. S. P.*), seventeen and one-half grammes (17.5 Gm.) [270 grs.]; hydrochloric acid (*U. S. P.*), four cubic centimeters (4 Cc.) [65 ♏]; glycerin, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; compound elixir of taraxacum (F. 111), sixty-five cubic centimeters (65 Cc.) (2 fl℥, 95 ♏]; alcohol, one hundred and seventy-five cubic centimeters (175 Cc.) [5 fl℥, 441 ♏]; purified talcum (F. 395), fifteen grammes (15 Gm.) [231 grs.]; sugar, two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.]; water, a sufficient quantity, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the pepsin with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of water, add the glycerin and acid, and agitate until solution has been effected. Then add the compound elixir of taraxacum, alcohol, and the purified talcum, and mix thoroughly. Set the mixture aside for a few hours, occasionally agitating. Then filter it through a wetted filter, dissolve the sugar in the filtrate, and pass enough water through the filter to make the whole product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents 1 grain of pepsin"—(*Nat. Form.*).

Elixir Pepsini, Bismuthi et Strychninæ (N. F.), *Elixir of pepsin, bismuth and strychnine.—Formulary number*, 89: "Strychnine sulphate, one hundred and seventy-five milligrammes (0.175 Gm.) [2.7 grs.]; elixir of pepsin and bismuth (F. 90), one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the strychnine sulphate in the elixir. Each fluid drachm represents $\frac{1}{100}$ grain of strychnine sulphate, 1 grain of pepsin, and 2 grains of bismuth and ammonium citrate"—(*Nat. Form.*). This execrable combination, in a pharmaceutical sense, has been one of the most popular American elixirs. Possibly, its chief advantage rests in the minute amount of strychnine present, and the fact that the incompatible nature of the pepsin and bismuth precipitates the former and destroys the latter.

Elixir Pepsini et Bismuthi (N. F.), *Elixir of pepsin and bismuth.—Formulary number*, 90: "Pepsin (*U. S. P.*), seventeen and one-half grammes (17.5 Gm.) [270 grs.]; bismuth and ammonium citrate, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; water of ammonia (*U. S. P.*), a sufficient quantity; glycerin, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; alcohol, one hundred and seventy-five cubic centimeters (175 Cc.) [5 fl℥, 441 ♏]; syrup (*U. S. P.*), two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; compound elixir of taraxacum (F. 111), sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; purified talcum (F. 395), fifteen grammes (15 Gm.) [237 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the pepsin in two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water. Dissolve the bismuth and ammonium citrate in sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏] of warm water, allow the solution to stand until clear, if necessary; then decant the clear liquid, and add to the residue just enough water of ammonia to dissolve it, carefully avoiding an excess. Then mix the two solutions, and add the glycerin, compound elixir of taraxacum, and alcohol. Thoroughly incorporate the purified talcum with the mixture, filter it through a wetted filter, and pass enough water through the filter to make the filtrate measure seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏]. To this add the syrup. Each fluid drachm represents 1 grain of pepsin, and 2 grains of bismuth and ammonium citrate"—(*Nat. Form.*).

Elixir Potassii Acetatis et Juniperi (N. F.), *Elixir of potassium acetate and juniper.—Formulary number*, 96: "Potassium acetate, eighty-five grammes (85 Gm.) [3 ozs. av.]; fluid extract of juniper (F. 164), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; magnesium carbonate, fifteen grammes (15 Gm.) [231 grs.]; aromatic elixir (*U. S. P.*), a sufficient quantity, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the fluid extract of juniper with the magnesium carbonate, then add seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of aromatic elixir in which the potassium acetate has previously been dissolved. Filter, and add enough aromatic elixir through the filter, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents 5 grains of potassium acetate and 7½ grains of juniper"—(*Nat. Form.*).

Elixir Rhamni Purshianæ (N. F.), *Elixir rhamnus purshiana, Elixir of cascara sagrada.—Formulary number*, 101: "Fluid extract of rhamnus purshiana (*U. S. P.*), two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; compound elixir of taraxacum (F. 111), seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏]. Mix them. Allow the mixture to stand a few days, if convenient, and filter. Each fluid drachm represents 15 grains of rhamnus purshiana"—(*Nat. Form.*).

Elixir Rhei (N. F.), *Elixir of rhubarb.—Formulary number*, 103: "Sweet tincture of rhubarb (*U. S. P.*), five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; deodorized alcohol, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; water, one hundred and eighty-five cubic centimeters (185 Cc.) [6 fl℥, 123 ♏]; glycerin, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; syrup (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]. Mix them and filter. Each fluid drachm represents about 2¼ grains of rhubarb"—(*Nat. Form.*).

Elixir Rubi Compositum (N. F.), *Compound elixir of blackberry.—Formulary number*, 105: "Blackberry root, one hundred and sixty grammes (160 Gm.) [5 ozs. av., 282 grs.]; galls, one hundred and sixty grammes (160 Gm.) [5 ozs. av., 282 grs.]; cinnamon, Saigon, one hundred and sixty grammes (160 Gm.) [5 ozs. av., 282 grs.]; cloves, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; mace, twenty grammes (20 Gm.) [309 grs.]; ginger, twenty grammes (20 Gm.) [309 grs.]; blackberry juice, recently expressed, thirty-seven hundred and fifty cubic centimeters (3750 Cc.) [126 fl℥, 385 ♏]; syrup (*U. S. P.*), eighteen hundred and seventy-five cubic centimeters (1875 Cc.) [63 fl℥, 192 ♏]; glycerin, eighteen hundred and seventy-five cubic centimeters (1875 Cc.) [63 fl℥, 192 ♏]; diluted alcohol (*U. S. P.*), a sufficient quantity to make ten thousand cubic centimeters (10,000 Cc.) [16 O, 82 fl℥, 66 ♏]. Reduce the solids to a moderately coarse (No. 40) powder, moisten it with diluted alcohol, and percolate it with this menstruum in the usual manner, until twenty-five hundred cubic centimeters (2500 Cc.) [84 fl℥, 257 ♏] of percolate are obtained. To this add the blackberry juice, syrup, and glycerin, and mix thoroughly"—(*Nat. Form.*).

Elixir Sodii Salicylatis (N. F.), *Elixir of sodium salicylate.—Formulary number*, 108: "Sodium salicylate, eighty-five grammes (85 Gm.) [3 ozs. av.]; aromatic elixir (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the sodium salicylate in about eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of aromatic elixir, by agitation. Then add enough aromatic elixir to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and filter, if necessary. This preparation should be freshly prepared, when required for use. Each fluid drachm contains 5 grains of sodium salicylate"—(*Nat. Form.*).

ELIXIR AROMATICUM (U. S. P.)—AROMATIC ELIXIR.

Synonym: *Simple elixir.*

Preparation.—"Compound spirit of orange, twelve cubic centimeters (12 Cc.) [195 ♏], syrup, three hundred and seventy-five cubic centimeters (375 Cc.) [12 fl℥, 327 ♏]; precipitated calcium phosphate, fifteen grammes (15 Gm.) [231 grs.]; deodorized alcohol, distilled water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. To the compound spirit of orange add enough deodorized alcohol to make two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]. To this solution add the syrup in several portions, agitating after each addition, and afterwards add, in the same manner, three hundred and seventy-five cubic centimeters (375 Cc.) [12 fl℥, 327 ♏] of distilled water. Mix the precipitated calcium phosphate intimately with the liquid, and then filter through a wetted filter, returning the first portions of the filtrate until a transparent liquid is obtained. Lastly, wash the filter with a mixture of one volume (1 vol.) of deodorized alcohol and three volumes (3 vol.) of distilled water, until the product measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Action and Medical Uses.—Carminative; generally employed as a flavoring agent.

ELIXIR PHOSPHORI (U. S. P.)—ELIXIR OF PHOSPHORUS.

Preparation.—"Spirit of phosphorus, two hundred and ten cubic centimeters (210 Cc.) [7 fl℥, 48 ♏]; oil of anise, two cubic centimeters (2 Cc.) [33 ♏]; glycerin, five hundred and fifty cubic centimeters (550 Cc.) [18 fl℥, 287 ♏]; aromatic elixir, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. To the spirit of phosphorus, contained in a graduated bottle, add the oil of anise and glycerin, and mix them by repeatedly inverting the bottle, until they form a clear liquid. Then add aromatic elixir, in several portions, gently agitating after each addition, until a transparent liquid is obtained, and the product measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Keep the product in dark, amber-colored, well-stoppered bottles, in a cool and dark place. Each cubic centimeter of elixir of phosphorus represents about $\frac{1}{4}$ milligramme (0.00025 Gm.) of phosphorus"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Phosphorus*). Dose, from $\frac{1}{2}$ to 1 fluid drachm (equivalent to $\frac{1}{130}$ to $\frac{1}{65}$ grain of phosphorus).

EMPLASTRA.—PLASTERS.

Plasters are designed to be applied upon the skin or surface of the body; they are of much thicker consistence than cerates, require a certain degree of heat to soften them sufficiently for spreading, and are very adhesive when applied to any part of the body. They are intended to fulfil four indications, viz.: to give mechanical support or pressure to certain parts; to hold cut surfaces in contact; to protect parts from atmospheric action; and to produce sedative, stimulant, or other therapeutical influences, according to the nature of the medicines associated with them. They are most usually composed of resins combined with wax, fats, and other substances, and frequently in combination with the oleo-stearate and palmitate of lead or lead plaster as a basis. Plasters should be prepared in some metallic vessel, as tin, or iron, which, in consequence of the uprising many articles undergo when heated, thereby augmenting their volume, should be considerably larger than required to hold the components of the plaster when in an unmelted condition. The heat should be continued no longer than is necessary to effect the proper amalgamation of the ingredients; and those of a volatile character should be added at as late a period during the cooling of the plaster as is consistent with their intimate combination with it. After having melted the wax and resinous substances, etc., together they should be strained while hot, to remove impurities, and, as the several articles required to form the plaster are added, the mass should be well stirred. Some plasters require to be stirred constantly till cold, while others are poured into cold water during their melted state, and worked by the hands, kneading them until nearly cold, and then forming them into cylindrical rolls, or sticks of various dimensions and shapes to suit the views of the operator. The cylinders are usually made by rolling portions of the plaster on a hard, smooth surface, kept constantly wet during the operation. If some of the components of a plaster are soluble in water, the plaster should not be worked in this fluid, but be allowed to cool, either in the vessel in which it is prepared, or in pans or cylinders made for the purpose. As the action of the air exerts an influence upon plasters, it is advisable to cover them with paper or tin-foil, in order to protect them as much as possible against this influence; and they should always be kept in dry and cool situations. Plasters should be hard and not adhesive, at atmospheric temperatures, and should not become too soft, but remain flexible and tenacious when exposed to the natural heat of the body. When a plaster softens under ordinary atmospheric warmth, it should be remelted, and more resin, or other of its solid constituents be added; if it is too firm, not being readily spread at a moderate heat, or not sufficiently adhesive when in contact with the body, a sufficient quantity of olive oil should be added upon remelting it.

Plasters are spread upon various materials in accordance with the object for which they are used. If they are designed to act as mechanical supports, to exclude atmospheric air, etc., white sheepskin is the best material; if they are to be applied to ulcers, to surfaces exposed by the removal of the skin, or to wounds for the purpose of holding the divided surfaces in close contact with each other, some softer material may be used, as muslin, etc. Sometimes oiled silk, or india-rubber cloth is employed, and where economy is desired, they are spread on stout paper. After cutting the leather somewhat larger than the size desired, paste strips of paper, about ½ inch wide, along the edges of the leather, and after having spread the plaster within the space which they inclose, remove them. The plaster should be spread thinly and evenly, always leaving an unspread edge or border, ½ inch wide, which serves to protect the linen worn over it from adhering to it There are various modes of spreading the plaster; some melt the plaster in a suitable vessel over a gentle fire, and spread it by means of a common spatula; others use an iron instrument made expressly for the purpose, which, when properly heated, they apply to the plaster; as this melts, the fused portion is dropped upon various parts of the leather, and the spreading is accomplished by carefully passing the same heated iron over the surface, carrying portions of the melted plaster along with it. Care must be taken not to heat the irons employed in spreading to too great a degree, else certain parts of the plaster may become volatilized or decomposed. When it is desired to obtain large quantities of plasters, they are spread by machines made for the purpose, and these factory-made spread plasters are now such favorites as to have practically displaced those of the pharmacist.

Adhesive material spread upon silk, muslin, or paper, makes adhesive and court plasters, of which the official *Emplastrum Capsici* and *Emplastrum Ichthyocollæ* are examples. Such preparations are known in Europe under the name *sparadrap*. *Porous plasters* are those which have been closely perforated by means of a metal wheel beset with punches. Elegant plasters are now manufactured on a large scale by specialists who use rubber and other plaster bases.

The following plasters containing mercury are official:

Emplastrum Ammoniaci Cum Hydrargyro (*U. S. P.*), *Ammoniac plaster with mercury.*—"Ammoniac, seven hundred and twenty grammes (720 Gm.) [1 lb. av., 9 ozs., 174 grs.]; mercury, one hundred and eighty grammes (180 Gm.) [6 ozs. av., 153 grs.]; oleate of mercury, eight grammes (8 Gm.) [123 grs.]; diluted acetic acid, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]; lead plaster, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lb. av., 3 ozs., 120 grs.]. Digest the ammoniac with the diluted acetic acid, in a suitable vessel, avoiding contact with metals, until it is entirely emulsified; then strain, and evaporate the strained liquid by means of a water-bath, stirring constantly, until a small portion, taken from the vessel, hardens on cooling. Triturate the oleate of mercury with the mercury gradually added, until globules of the metal cease to be visible. Next add, gradually, the ammoniac, while yet hot; and finally, having added enough lead plaster, previously melted by means of a water-bath, to make the mixture weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.], and mix the whole thoroughly"—(*U. S. P.*). This plaster frequently excites an eczematous eruption, and may produce ptyalism. It is more active than plaster of mercury, and is used to discuss *syphilitic swellings.* It is not employed in Eclectic practice.

Emplastrum Hydrargyri (*U. S. P.*), *Mercurial plaster.*—"Mercury, three hundred grammes (300 Gm.) [10 ozs. av., 255 grs.]; oleate of mercury, twelve grammes (12 Gm.) [185 grs.]; lead plaster, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.] Triturate the mercury with the oleate of mercury in a tared capsule until globules of metal are no longer visible. Then place the capsule on a water-bath, add enough lead plaster, previously melted, to make the contents weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.], and mix the whole thoroughly"—(*U. S. P.*). Used as a counter-irritant and stimulating discutient to remove *syphilitic nodes, glandular swellings of syphilis, syphilitic engorgements of the liver*, and *splenic enlargements* of malarial origin. May produce sore gums and ptyalism. Not employed in Eclectic medicine.

The *U. S. P.* of 1880 directed the following plasters, the amounts being those in the metric system as given in the *National Formulary:*

Emplastrum Ammoniaci (N. F.) (*U. S. P.*, 1880), *Ammoniac plaster.—Formulary number*, 116: "Ammoniac, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; diluted acetic acid, one hundred and forty cubic centimeters (140 Cc.) [4 fl℥, 352 ♏]. Digest the ammoniac with the diluted acetic acid, in a suitable vessel, avoiding contact with metals, until it is entirely emulsionized; then strain and evaporate the strained liquid, by means of a water-bath, stirring constantly, until a small portion, taken from the vessel, hardens on cooling"—(*Nat. Form.*).

Emplastrum Galbani (N. F.) (*U. S. P.*, 1880), *Galbanum plaster.—Formulary number*, 120: "Galbanum, sixteen grammes (16 Gm.) [247 grs.]; turpentine, two grammes (2 Gm.) [31 grs.]; burgundy pitch, six grammes (6 Gm.) [92 grs.]; lead plaster, seventy-six grammes (76 Gm.) [2 ozs. av., 298 grs.]. To the galbanum and turpentine, previously melted together and strained, add, first, the burgundy pitch, then the lead plaster, melted over a gentle fire, and mix the whole thoroughly"—(*Nat. Form.*).

Galbanum plaster of the *British Pharm.* consists of 1 ounce (av.) each of galbanum, ammoniacum, and yellow wax, and 8 ounces (av.) of lead plaster. The galbanum and ammoniacum are melted together and strained, and subsequently the wax and lead plaster, also melted together, are added, and the whole mass thoroughly mixed together.

Emplastrum Galbani Rubrum, or Emplastrum Oxycroceum.—The *German Pharmacopœia*, of 1872, directed the following plaster, much employed by the German people in America: Melt together, with moderate heat, 6 parts each of resin, burgundy pitch, and yellow wax; strain; now add to 3 parts of turpentine, 2 parts each of powdered ammoniac and galbanum. Add this solution to the first part. Next add to the whole mixture 1 part of powdered saffron, and 2 parts each of powdered mastic, olibanum and myrrh, all previously intimately mixed, and mix the whole mass together. An excellent stimulating plaster for local affections.

Emplastrum Picis Canadensis (N. F.) (*U. S. P.*, 1880), *Canada pitch plaster.—Formulary number*, 121: "Canada pitch, ninety grammes (90 Gm.) [3 ozs. av., 76 grs.]; yellow wax, ten grammes (10 Gm.) [154 grs.]. Melt them together, strain the mixture, and stir constantly until it thickens on cooling"—(*Nat. Form.*).

The following plasters are sometimes used:

Emplastrum Cerussæ (*Emplastrum album coctum*), *White lead plaster.*—Lead plaster, 60 parts; olive oil, 10 parts. Melt together. Add lead carbonate (in fine powder), 35 parts. This, with the addition of a little water, as needed, is to be boiled until a plaster consistence is obtained. This is a German official plaster.

Mahy's Plaster resembles the preceding, excepting that it contains, in addition. powdered orris root and a small amount of wax.

EMPLASTRUM ACONITI.—ACONITE PLASTER.

Preparation.—Take of aconite root, in coarse powder, 4 troy ounces, moisten it with 6 fluid ounces of alcohol, sp. gr. 0.835, and permit it to macerate 24 hours; then put it in a displacer, and pour on gradually alcohol, sp. gr. 0.835, a sufficient quantity to make a pint of tincture. Distill off ¾ of the alcohol, evaporate the residue on a water-bath to a thick, syrupy consistence, then add lead plaster, in a melted state, 3½ troy ounces, and stir constantly until it is properly incorporated with the soft resinous extract, and cools.

Description.—This forms a brown, homogenous mass, weighing about 4 troy ounces. It should, when used, be spread in a thin layer on skin or oiled-silk, and may be used several times when its application has not been too long continued at first. It is considered superior to that in which only aconitine enters, being more uniform in its strength and of equal efficacy.

Action and Medical Uses.—It possesses the medicinal efficacy of the root, and has been found a valuable application in *neuralgia*, *headache*, *rheumatic pains*, *painful tumors of the breast* and other parts, and in *inflammatory dysmenorrhœa* (W. Procter, Jr.).

EMPLASTRUM ARNICÆ (U. S. P.)—ARNICA PLASTER.

Preparation.—"Extract of arnica root, three hundred and thirty grammes (330 Gm.) [11 ozs. av., 280 grs.]; resin plaster, six hundred and seventy grammes (670 Gm.) [1 lb. av., 7 ozs., 277 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Add the extract to the plaster, previously melted by means of a water-bath, and mix them thoroughly"—(*U. S. P.*).

Action and Medical Uses.—A stimulant, useful as an application to *painful* or *sprained joints*, *chronic rheumatic pains*, *weak back*, etc.

EMPLASTRUM AROMATICUM (N. F.)—AROMATIC PLASTER.

SYNONYM: *Spice plaster.*

Preparation.—*Formulary number*, 117: "Cloves, ten grammes (10 Gm.) [154 grs.]; cinnamon, Saigon, ten grammes (10 Gm.) [154 grs.]; ginger, ten grammes (10 Gm.) [154 grs.]; capsicum, five grammes (5 Gm.) [77 grs.]; camphor, five grammes (5 Gm.) [77 grs.]; cotton seed oil, thirty-five grammes (35 Gm.) [1 oz. av., 102 grs.]; lead plaster, twenty-five grammes (25 Gm.) [386 grs.]. Melt together the lead plaster and cotton seed oil, with the aid of heat. Cool the mixture and, while it is still soft, thoroughly incorporate with it the aromatic ingredients, previously reduced to a very fine powder"—(*Nat. Form.*).

Action and Medical Uses—This is an excellent stimulating application for the relief of *local pains*, especially of the chest and abdomen, and to palliate the pains of *rheumatism* and *neuralgia.*

EMPLASTRUM BELLADONNÆ (U. S. P.)—BELLADONNA PLASTER.

Preparation.—"Alcoholic extract of belladonna leaves, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; resin plaster, four hundred grammes (400 Gm.) [14 ozs. av., 48 grs.]; soap plaster, four hundred grammes (400 Gm.) [14 ozs. av., 48 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Melt the plasters on a water-bath; then add the extract of belladonna leaves, and continue the heat, stirring constantly, until a homogeneous mass results"—(*U. S. P.*). For uses, see *Belladonna.*

EMPLASTRUM BELLADONNÆ COMPOSITUM.—COMPOUND PLASTER OF BELLADONNA.

Preparation.—Take of resin plaster, 5 troy ounces; alcoholic extract of belladonna root, 1 troy ounce; alcoholic extract of conium maculatum, 1½ troy ounces; pulverized iodine, 40 grains. Place the plaster in an earthenware mortar, and put this in hot water. When the plaster commences to melt, add the extracts of belladonna and conium, and rub the ingredients well together; then take the mortar from the water-bath, continuing the trituration, and, when nearly cool, add the iodine. The inspissated juices of the above narcotics are preferable to the ordinary extract in preparing this plaster.

Action and Medical Uses.—This plaster may be used for the same purposes as the belladonna plaster, and is also an excellent application over *scrofulous* and other *tumors*, *white-swelling*, and *goitre;* and may likewise be applied over the region of the liver and spleen for chronic affections of these organs, and over the lumbar vertebræ in severe *dysmenorrhœa.* Like the preceding plaster, it occasionally affects the constitution, and then requires to be omitted for a few days (J. King).

EMPLASTRUM CAPSICI (U. S. P.)—CAPSICUM PLASTER.

SYNONYM: *Sparadrapum capsici.*

Preparation.—"Oleoresin of capsicum, resin plaster, each, a sufficient quantity. Melt the resin plaster at a gentle heat, spread a thin and even layer of it upon muslin, and allow it to cool. Then, having cut off a piece of the required size, apply a thin coat of oleoresin of capsicum, by means of a brush, leaving a narrow, blank margin along the edges. A space of ten centimeters (10 Cm.) [3.94 inches] square should contain about twenty-five centigrammes (0.25 Gm.) [3.85 grains] of oleoresin of capsicum"—(*U. S. P.*).

Action and Medical Uses.—This plaster is stimulant and slightly rubefacient. It may be applied where a mild counter-irritant is needed in *neuralgic, rheumatic*, and other *painful conditions.*

EMPLASTRUM CAPSICI COMPOSITUM.—COMPOUND CAPSICUM PLASTER.

SYNONYMS: *Common strengthening plaster, Sear-cloth plaster.*

Preparation.—Take of rosin, 4 troy ounces; yellow wax, 1 troy ounce; tincture of capsicum, ½ pint. Melt the rosin and wax, and add the tincture; keep stirring by a gentle heat, until the alcohol is evaporated; then remove from the fire, and, when nearly cold, add pulverized camphor, ½ troy ounce; oil of sassafras, 45 minims. Stir until cold (Beach's *Amer. Prac.*).

Action and Medical Uses.—This forms a gently stimulating and strengthening plaster, and may be used in all cases where artificial support, prevention of the contact of atmospheric air, or mild stimulation is required. It was a great favorite with Eclectic physicians 25 years ago, and is still extensively used by them.

EMPLASTRUM FERRI (U. S. P.)—IRON PLASTER.

SYNONYMS: *Strengthening plaster, Emplastrum ferratum, Chalybeate plaster, Emplastrum martiale, Emplastrum roborans.*

Preparation.—"Ferric hydrate, dried at a temperature not exceeding 80° C. (176° F.), ninety grammes (90 Gm.) [3 oz. av., 76 grs.]; olive oil, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; burgundy pitch, one hundred and forty grammes (140 Gm.) [4 ozs. av., 411 grs.]; lead plaster, seven hundred and twenty grammes (720 Gm.) [1 lb. av., 9 ozs., 174 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Melt the lead plaster and burgundy pitch by means of a water-bath, and add the olive oil; then add the ferric hydrate, and stir constantly until the mixture thickens on cooling"—(*U. S. P.*).

Action and Medical Uses.—This plaster is stimulating, protective, and supporting. It is applied to the chest during the latter stage of *pleurisy*, to *glandular enlargements*, and to *rheumatic joints* and *muscles*. It is sometimes applied to *weak backs*. It has nothing in particular to recommend it.

EMPLASTRUM ICHTHYOCOLLÆ (U. S. P.)—ISINGLASS PLASTER.

SYNONYMS: *Court plaster, Sparadrapum adhæsivum, Taffetas adhæsivum, Emplastrum adhæsivum anglicum, Sericum anglicum.*

Preparation.—"Isinglass, ten grammes (10 Gm.) [154 grs.]; alcohol, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; glycerin, one gramme (1 Gm.) [15 grs.]; water, tincture of benzoin, each, a sufficient quantity. Dissolve the isinglass in a sufficient quantity of hot water to make the solution weigh one hundred and twenty grammes (120 Gm.) [4 ozs. av., 102 grs.]. Spread one-half of this, in successive layers, upon taffeta (stretched on a frame), by means of a brush, waiting after each application until the layer is dry. Mix the second half of the isinglass solution with the alcohol and glycerin, and apply it in the same manner. Then reverse the taffeta, coat it on the back with tincture of benzoin, and allow it to become perfectly dry. Cut the plaster in pieces of suitable length and preserve them in well-closed vessels. The above-directed quantities are sufficient to cover a piece of taffeta thirty-eight centimeters (38Cm.) [about 16 inches] square"—(*U. S. P.*). The glycerin is added to this plaster to give it pliability, while the benzoin renders it partially water-proof. Pharmacists now purchase all their court plaster from plaster manufacturers.

Action and Medical Uses.—This is the ordinary isinglass plaster employed for covering minor injuries, as *abrasions, slight cuts, pimples*, etc. It should be applied by moistening it with clean water, and never with saliva.

Related Preparations.—GELANTHUM. Gelanthum is a kind of varnish of the collodion class, having about the consistency of Unguentum Glycerini. It was devised by Dr. Unna. It is made by W. Mielck in Hamburg, apothecary of the Schwanen-Apotheke, who is also the proprietor of the copyrighted name Gelanthum. Unna endeavored to find a vehicle that would allow the fixing of the various medicaments upon the skin, and which would be capable of drying quickly. This he at last accomplished by means of a combination of gelatin and tragacanth. Unguentum Caseini, which has hitherto been considered the best substance for this purpose, does not possess the property of absorbing all medicaments without decomposition, nor does it keep for an indefinite length of time. Nevertheless, Unna states that, in certain cases, unguentum caseini is preferable to gelanthum, since the casein salve is a better medium for carrying the different kinds of tar, and since casein itself exerts a beneficial influence in the case of thickening of the epidermis.

Preparation of Gelanthum. The tragacanth, in pieces, is to be treated with 20 times its weight of cold water for 3 to 4 weeks, with frequent agitation; then heated over steam for one day, and pressed through cheese cloth. The gelatin likewise is swollen in cold water (4 to 5 parts), exposed for some time to steam under pressure, in order to deprive it of the tendency to gelatinize, and is then filtered through a steam filtering funnel. This filtrate is mixed with the tragacanth mucilage and the mixture heated for about 2 days in a steam bath, again strained, and finally mixed with 5 per cent of glycerin, some rose water (preferably a few drops of oil of rose), and thymol (2:10,000). The finished gelanthum contains about 2 per cent each of gelatin and tragacanth. This gelanthum may safely be mixed with as much as 50 per cent of ichthyol, 40 per cent salicylic acid, resorcin and pyrogallol, 5 per cent carbolic acid, or 1 per cent mercuric chloride without impairing its qualities as a varnish. Incompatibles incorporated into gelanthum are said not to act upon each other, still it is recommended to first triturate them, if in powder form, or as a viscid liquid, with water or spirits as the case may require; fats and oils should first be emulsified by means of gum Arabic. An addition of 20 per cent glycerin, or of 40 per cent ichthyol does not affect the drying qualities of gelanthum.

GELANTHE CRÈME is a preparation introduced by the Schwanen-Apotheke in Hamburg as a cosmetic, and consists of 10 per cent of fat and some perfume admixed with gelanthum (*Pharm. Centralhalle*, 1896, pp. 183 and 815).

EMPLASTRUM MENTHOL.—MENTHOL PLASTER.

Preparation.—Melt together resin, 7 ounces (av.), and yellow wax, 1 ounce (av.). Stir into the mixture, as it cools, menthol, 2 ounces (av.).

Action and Medical Uses.—This plaster is now official in the *Br. Pharm.* It is designed as a counter-irritant, and is used for *local pains*, *neuralgic* or *rheumatic* in character, and in *migraine*.

EMPLASTRUM MYRICÆ.—BAYBERRY PLASTER.

SYNONYM: *Green salve.*

Preparation.—Take of white gum turpentine and bayberry wax, each 2 troy ounces. Melt together, strain, and stir till cold. In winter a small quantity of olive oil may be added (Beach's *American Practice*).

Action and Medical Uses.—This forms a very valuable and efficient application to *scrofulous* and other *ulcers;* also to many *cutaneous affections*. It is often prepared of the consistence of an ointment for these purposes (see *Bayberry Ointment*).

EMPLASTRUM OPII (U. S. P.)—OPIUM PLASTER.

SYNONYMS: *Emplastrum odontalgicum, Emplastrum cephalicum, Emplastrum opiatum.*

Preparation.—"Extract of opium, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; burgundy pitch, one hundred and eighty grammes (180 Gm.) [6 ozs. av., 153 grs.]; lead plaster, seven hundred and sixty grammes (760 Gm.) [1 lb. av., 10 ozs., 355 grs.]; water, eighty cubic centimeters (80 Cc.) [2 fl℥, 339 ♏); to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Rub the extract of opium with the water until it is uniformly soft, and add it to the burgundy pitch and lead plaster melted together by means of a water-bath; then continue the heat for a short time, stirring constantly, until the moisture is evaporated"—(*U. S. P.*).

Action and Medical Uses.—This plaster is designed as an application to fulfil many of the purposes for which opium is used externally, as for the relief of *painful parts*, as in *rheumatism*, *neuralgia*, *odontalgia*, etc.

EMPLASTRUM PICIS BURGUNDICÆ (U. S. P.)—BURGUNDY PITCH PLASTER.

Preparation.—"Burgundy pitch, eight hundred grammes (800 Gm.) [1 lb. av., 12 ozs., 96 grs.]; olive oil, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; yellow wax, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Melt together the burgundy pitch and yellow wax, then incorporate the olive oil, and stir constantly until the mass thickens on cooling"—(*U. S. P.*).

Action and Medical Uses.—This plaster is stimulant, and may be employed where a mild counter-irritant is demanded, as well as for a strengthening or supporting plaster. Occasionally the pitch plaster will be found to cause, and keep up a discharge of serum, and when it does so, it should be often renewed.

EMPLASTRUM PICIS CANTHARIDATUM (U. S. P.)—CANTHARIDAL PITCH PLASTER.

SYNONYMS: *Warming plaster, Warm plaster.*

Preparation.—"Cerate of cantharides, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; burgundy pitch, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Melt the cerate of cantharides on a water-bath containing boiling water, and continue the heat for 15 minutes; then strain it through a piece of muslin of close texture so that the cantharides will be retained on the muslin. To the strained liquid add a sufficient quantity of burgundy pitch to make the whole weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; render the mixture homogeneous by stirring, remove the heat, and stir the mass until it thickens on cooling'"—(*U. S. P.*).

It is necessary that the cantharides be in very fine powder. The direction to strain the cerate through muslin is very essential, that none of the particles of cantharides of any considerable size may come in contact with the skin and vesicate it.

Action and Medical Uses.—This plaster is a mild counter-irritant, and is considered useful in *chronic articular diseases, chronic rheumatism*, and such chest diseases as *chronic bronchitis, chronic pleurisy*, and in *pulmonary engorgement* of tubercular character. Also applied in *phthisis, asthma, whooping-cough, bronchial catarrh, hepatitis*, etc.

EMPLASTRUM PICIS COMPOSITUM.—COMPOUND TAR PLASTER.

SYNONYMS: *Irritating plaster.*

Preparation.—Take Burgundy pitch, 24 troy ounces; white turpentine, 16 troy ounces; melt them together, add tar 48 troy ounces, stir well together and strain, remove from the fire, and add finely-powdered mandrake root, blood-root, poke-root, Indian turnip, each 10 troy ounces. Incorporate well together (T. V. Morrow). When it is desired to produce a more active preparation, and one which will act more promptly, euphorbium, in powder, 4 troy ounces, is added to the above.

Action and Medical Uses.—This plaster is irritant, rubefacient, and suppurative. It is used extensively in many cases where counter-irritation or powerful revulsion is indicated, in *neuralgia, rheumatism*, and in the majority of *painful chronic diseases*. It acts more efficiently, and is much more adhesive when spread quite thin, on soft leather, than when spread on any kind of cloth; though it may be spread on oil-silk, india-rubber cloth, or other substance that will not absorb any portion of it. This plaster may be held in place by a bandage or two, as it has to be removed daily, but when it is desired to have a firmer adhesion to the skin, some adhesive plaster may be applied around the margin left on the material upon which the tar plaster is spread. When applied to a part of the body, it must be removed daily, for the purpose of thinly respreading the same piece of leather, or oil-silk, etc., with the plaster, which is to be immediately reapplied upon the part. This course is to be continued until the surface, to which it is applied, commences discharging matter, after which it should be removed 2 or 3 times a day, wiping it quite dry each time before respreading it, and likewise carefully drying the sore as much as possible. This latter is best accomplished by lightly pressing upon it soft pieces of dry cotton, linen, or lint, so as to absorb all the pus. The practitioner must bear in mind that he is never, no matter what may be the condition of the sore or surrounding parts, to wet it; this will render it irritable and inflamed, and cause it to cease suppurating healthily, and even to require its immediate healing.

This plaster is very painful, producing more or less irritability of the system, and should never be used except when its use is indispensable; when it becomes very painful and irritating, depriving the patient of sleep, or causing him to complain loudly, it must be removed, and a slippery-elm poultice be applied. Many practitioners consider the disturbance of sleep, alone, as an indication for removing the plaster, which may be reapplied when it is desirable to continue the suppurative discharge for a longer time, as soon as the elm poultice has allayed the local irritation. If this is not required, the sore may be healed by some simple application, as simple cerate, a mixture of beeswax and tallow, red oxide of lead plaster, etc. Whenever the tar plaster or the dressing to the sore produced by it, are removed for renewal, the sore should each time be cleansed from matter in the manner referred to above. As the peculiar odor of the ingredients of this plaster may be observed in the excretions, there is no doubt but that they are absorbed into the system, and exert an alterative as well as a counter-irritating influence.

EMPLASTRUM PLUMBI (U. S. P.)—LEAD PLASTER.

SYNONYMS: *Diachylon plaster, Emplastrum diachylon simplex, Litharge plaster, Emplastrum album coctum.*

Preparation.—"Lead oxide, three thousand two hundred grammes (3200 Gm.) [7 lbs. av., 384 grs.]; olive oil, six thousand grammes (6000 Gm.) [13 lbs. av., 3 ozs., 282 grs.]; water, a sufficient quantity. Mix the lead oxide, previously passed through a No. 80 sieve, intimately with about ½ of the olive oil, by trituration, and add the mixture to the remainder of the oil contained in a bright copper boiler of a capacity equal to at least 4 times the bulk of the ingredients. Then add one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏︎] of boiling water, and boil the whole together, over a fire, constantly stirring with a wooden spatula, until a small portion, when dropped into cold water, is found to be pliable and tenacious. From time to time add a little water to replace that lost by evaporation. When the contents of the boiler have acquired a whitish color and are perfectly homogeneous, transfer them to a vessel containing warm water, and as soon as the mass has sufficiently cooled, knead it well with the water so as to remove the glycerin, renewing the water from time to time, as long as it may be necessary. Finally divide the mass into rolls of suitable size"—(*U. S. P.*).

In the method here given, the formation of the plaster is rapid when the oxide of lead is in fine powder. Stirring facilitates the combination, by intimately mixing the particles, and preventing the oxide from adhering to the bottom of the vessel. To a practiced pharmacist the tenacity and consistence of the mass indicates when the reaction is complete. The reaction here involved, which is that of ordinary saponification, requires the addition of water as an indispensable ingredient, in order to make the formation of glycerin possible, as will be seen from the following equation which takes into account pure *olein* only: $2C_3H_5(C_{18}H_{33}O_2)_3\,(\textit{olein}) + 3PbO\,(\textit{lead oxide}) + 3H_2O\,(\textit{water}) = 3Pb(C_{18}H_{33}O_2)_2\,(\textit{lead oleate}) + 2C_3H_5(OH)_3\,(\textit{glycerin})$.

Description and Tests.—Lead plaster, or *diachylon*, as it is frequently termed, is a grayish-white body, brittle when cold, plastic when warm, insoluble in water or alcohol, and partially soluble in ether. In the official description it is described as yellowish-white, but as a rule it is evenly grayish-white, unless old, when it changes on the surface to a yellowish or light-brownish hue. We have seen this plaster of a decidedly green color from the employment of "virgin" or the green olive oil. "A yellowish-white, pliable, and tenacious, but not greasy mass, gradually acquiring a brownish tint on the outside. On treating 5 Gm. of lead plaster with 25 Cc. of benzol, a somewhat viscid and slightly turbid solution will result, which will separate into a clear and a gelatinous layer after some time, but which should not deposit any sediment (absence of uncombined lead oxide)"—(*U. S. P.*).

Action and Medical Uses.—Lead plaster is chiefly used as a basis for other plasters. It is used in surgery on account of its adhesiveness and mildness of local action, rarely causing irritation. It is used to keep the edges of *wounds* together, and as an application to *blistered and chafed surfaces*, and occasionally to some *ulcers*, all of which it serves to protect from atmospheric influence. The sedative character of the lead used in its formation, probably assists its beneficial action.

An ointment is in considerable use as a dressing for *burns*, *scalds*, and *chilblains*, and various *cutaneous affections* accompanied with a burning or smarting sensation. It is prepared as follows: "Take of lead plaster, 24 troy ounces, melt it by a gentle heat, and, when melted, add to it oil of turpentine, 9 fluid ounces; linseed oil, 3 fluid ounces; oil of origanum, 16 fluid ounces; tincture of opium, 3 fluid ounces. Stir the articles constantly until the mass has sufficiently cooled. This is applied by completely and thickly covering the affected part with the ointment, over which a layer of raw cotton is to be placed, and allowed to remain until the part is well. In the case of deep burns, should the pain return after a few hours, the ointment should be removed, softening it with some warm oil, and a cataplasm of elm bark, or flax seed. be applied. It is said to afford prompt relief. Should the burn be extensive, care must be taken not to apply the ointment over the whole of it, but only over a portion at a time. This old Eclectic ointment we have recognized under a fanciful proprietary name, extensively lauded to the regular profession as a wonderful remedy for burns.

EMPLASTRUM PLUMBI IODIDI.—IODIDE OF LEAD PLASTER.

Preparation.—Take lead iodide, 1 part (2 ounces av.); lead plaster, 8 parts (1 pound av.); resin, 1 part (2 ounces av.). Melt the resin and lead plaster at the lowest possible temperature, add the lead iodide, in fine powder, and mix intimately. This accords with the *Br. Pharm.*

Action and Medical Uses.—Discutient. Useful application for *arthritis*, *rheumatism*, and for topical use on *indurations*, the result of *inflammations*.

EMPLASTRUM PLUMBI OXIDI RUBRUM.—RED OXIDE OF LEAD PLASTER.

Synonym: *Black salve.*

Preparation.—Take of olive oil, 1 quart; rosin, beeswax, each, 1 troy ounce. Melt together in a capacious iron kettle and raise the mixture nearly to the decomposition point; then gradually add pulverized red lead, 12 troy ounces. Stir constantly; when the lead is taken up by the oil, the mixture becomes brown, or shining black; then remove from the fire, and when nearly cold add of pulverized camphor, 80 grains. It should not be removed from the fire until its consistency is such that it may be spread easily, which may be ascertained by removing small portions of it from time to time, on a knife, and testing this when cold. (Beach's *American Practice*).

This is practically the old *Nuremburg plaster* of the *German Pharmacopœias*, the formula for which is as follows: Take of red lead, 8 troy ounces; olive oil, 16 troy ounces; mix, and expose to a heat until the mixture assumes a brown or blackish appearance, and then add rosin, ½ troy ounce; yellow wax, 1½ troy ounces; camphor, 2 drachms; stir thoroughly together.

In the preparation of this plaster it must be remembered that olive oil requires a heat of about 315.5° C. (600° F.) for ebullition; and should bubbles be observed when the heat is only 100° C. (212° F.), it will probably be owing to the presence of water. If the oil itself is not brought nearly to the boiling point, the red lead will not be acted upon; hence, the operator should not add this until the oil has been so far heated as to scorch a feather when dipped into it. Several preparations similar to these have been employed from time to time, one being the *Universal*, or *Breast plaster*, often sold as a secret nostrum under various names.

It is made by boiling together, with constant stirring, red oxide of lead (in fine powder), 2 parts, and olive oil, 4 parts. When the melted mass has assumed a deep-brown color, add yellow wax, 1 part. This constitutes the *Emplastrum fuscum*, *Emplastrum matris fuscum*, *Emplastrum noricum*, *Emplastrum nigrum*, etc. Camphor (1 per cent) added to the above produces the *Emplastrum fuscum camphoratum* of the Germans.

Action and Medical Uses.—This is a valuable application in *burns*, many *cutaneous affections*, and *syphilitic*, *scrofulous*, *fistulous*, and all other species of *ulcers*. A preparation similar to the above is employed by many practitioners in preference. It is made as follows: Heat 2 quarts of linseed oil until it will scorch a feather; then gradually add 16 troy ounces of red lead in powder; when the red lead is taken up by the oil, and the mixture is black, remove from the fire, and when nearly cold add 2 troy ounces of oil of turpentine, and stir until the mixture is cold.

Related Preparation.—EMPLASTRUM FUSCUM CAMPHORATUM (N. F.), *Camphorated brown plaster*, *Emplastrum matris camphoratum*, *Camphorated mother plaster.*—*Formulary number*, 119: "Red oxide of lead, three hundred grammes (300 Gm.) [10 ozs. av., 255 grs.]; olive oil, six hundred grammes (600 Gm.) [1 lb. av., 5 ozs., 72 grs.]; yellow wax, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; camphor, ten grammes (10 Gm.) [154 grs.]. Triturate the red oxide of lead with a portion of the oil in a capacious copper kettle until a smooth paste results. Then add the remainder of the oil, excepting a small quantity required for trituration with the camphor, and boil the whole over a naked fire, under constant stirring, until gas bubbles rise, or until the red color of the mixture begins to turn brown. Then moderate the heat, but continue the stirring until the mixture has acquired a dark-brown color, and from time to time allow some drops of it to fall into cold water to test its consistence. When this is satisfactory, remove the vessel from the fire, add the wax in small pieces, and finally the camphor, previously rubbed to a smooth paste with a little olive oil. Mix thoroughly, allow the mixture to become somewhat cool, and while it is still warm, pour the plaster into paper molds, previously coated with mucilage, containing about 5 per cent of glycerin, and dried. *Note.*—This preparation is official in the *German Pharmacopœia*"—(*Nat. Form.*). The preceding closely resembles the Eclectic black salve.

EMPLASTRUM RESINÆ (U. S. P.)—RESIN PLASTER.

SYNONYMS: *Adhesive plaster*, *Sticking plaster.*

Preparation.—"Resin, in fine powder, one hundred and forty grammes (140 Gm.) (4 ozs. av., 411 grs.]; lead plaster, eight hundred grammes (800 Gm.) [1 lb. av., 12 ozs., 96 grs.]; yellow wax, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; to make one thousand grammes (1000 Gm.); [2 lbs. av., 3 ozs., 120 grs.]. Melt the lead plaster and yellow wax together with a gentle heat, then add the resin, and, when it is melted, mix the mass thoroughly"—(*U. S. P.*).

This preparation, when spread on muslin, forms the ordinary *Adhesive plaster;* as age impairs its adhesiveness, fresh supplies should be obtained frequently. Sometimes powdered Castile soap is added to it, which increases its plasticity without diminishing its adhesiveness, and renders it less brittle in winter. If a small band of adhesive plaster be used as though it were paper, the writing being made on its reverse side, then warmed and placed upon a bottle, it will form an excellent label for vessels kept in cellars and damp places. In place of ink, varnish may be used, colored with vermilion, and then both ink and label resist the action of water and moisture.

Action and Medical Uses.—This plaster is more irritating, as well as more adhesive than *Lead plaster*. It is used in surgery to hold the edges of *wounds* together, to keep the dressings of *ulcers*, etc., in place, to make pressure upon, or give support to parts, and for the same purposes as the lead plaster. It is sufficiently irritating in its composition, without having any other stimulating agents combined with it.

EMPLASTRUM RESINÆ COMPOSITUM.—COMPOUND RESIN PLASTER.

SYNONYM: *Adhesive and Strengthening plaster.*

Preparation.—Take of white resin, 12 troy ounces; yellow wax, burgundy pitch, tallow, of each, 1 troy ounce. Melt together, and add olive oil, pulverized, camphor, and sassafras oil, of each, 1 drachm; West India rum, 1 fluid ounce. Incorporate well together, then pour the whole into cold water, and work it in the hands until cold, forming it into rolls or sticks (Beach's *American Practice*).

Action and Medical Uses.—This forms an adhesive and strengthening plaster, used in *rheumatism, weakness of the joints, wounds, ulcers*, etc. It is possessed of considerable stimulating property, and has been frequently used by practitioners, yet, notwithstanding, it is an unscientific preparation, as the rum and tallow will not be found to unite readily. The Emplastrum Capsici Compositum, is a much better article to use for the same purposes.

EMPLASTRUM SAPONIS (U. S. P.)—SOAP PLASTER.

Preparation.—"Soap, dried and in coarse powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; lead plaster, nine hundred grammes (900 Gm.) [1 lb. av., 15 ozs., 327 grs.); water, a sufficient quantity. Rub the soap with enough water to reduce it to a semi-liquid state; then mix it with the lead plaster, previously melted, and evaporate to the proper consistence"—(*U. S. P.*). It is important that the soap be in powder form, in order to insure a perfect mixture with water, and that the water be afterward evaporated, so that the plaster will possess good adhesive qualities.

Action and Medical Uses.—This plaster, spread on leather, is used as a discutient and mechanical support. It will be found very useful as an application for constant wear, to aid in softening and removing *corns*, after they have been carefully shaved down. The addition of iodine and camphor will greatly improve its utility in this respect.

EMPLASTRUM SAPONIS FUSCUM.—BROWN SOAP PLASTER.

Synonyms: *Emplastrum cerati saponis, Soap cerate plaster.*

Preparation.—Boil together by means of a steam bath, lead oxide, 15 ounces (av.), and vinegar, 1 gallon (Imp.), with constant stirring, until the acid and the oxide combine. Add powdered curd soap, 10 ounces (av.), and again boil the mixture until the greater portion of the moisture is dissipated. Lastly, add yellow wax, 12½ ounces (av.), and olive oil, 1 pint (Imp.), previously melted together. With constant stirring maintain the heat until the remaining moisture has sufficiently evaporated to give a plaster consistence to the product. This product is in reality a cerate, and is the same as the *Ceratum Saponis Compositum* of the *London Pharmacopœia*. A similar preparation is that of the *U. S. P.* (1870), as follows: Take of soap plaster, 2 troy ounces; white wax, 2½ troy ounces; olive oil, 4 troy ounces. Melt together the plaster and the wax, add the oil, and after continuing the heat a short time, stir the mixture until cool—(*U. S. P.*, 1870).

Gerrard proposes the substitution of acetic acid (18 ounces) in place of the vinegar. This quickens the process by shortening the time required for boiling.

Action and Medical Uses.—This plaster is employed where a cooling sedative cerate is desired. It is adapted to *chronic inflammatory swellings*, as of *scrofula, arthritic enlargements*, etc. It also serves as an adhesive plaster.

EMULSA.—EMULSIONS.

The class emulsions comprises milk-like mixtures of liquids and solids. The term emulsion is restricted to oleaginous, fatty, or resinous bodies in a watery menstruum. The agents chiefly employed to emulsify fixed oils are the mucilages of acacia, tragacanth, chondrus, dextrin, yolk of egg, and sometimes tincture of quillaja; the latter, however, is somewhat toxic. Emulsions made with egg do not keep well. Acacia enters into the composition of most emulsions. Solutions of pancreatin or liquor potassæ are rarely used. Emulsions of volatile oils may be made by rubbing the oil with some solid intended as an ingredient, or with sugar, syrup, or glycerin. If it be such an oil as oil of turpentine the emulsion may be improved by first mixing it with an equal bulk of a fixed oil, as olive oil, oil of sweet almond, or oil of sesamum, and afterwards proceeding as with the fixed oils. With the resins suspension is effected by means of mucilages; with the gum-resins water only is required, inasmuch as the mucilage thus formed by the gummy material of the gum-resin holds the resinous particles in suspension. Emulsions prepared by means of an alkaline emulsifier precipitate upon the addition of acids; emulsions prepared with mucilages or with the yolk of egg are precipitated by the addition of an excess of saline or alcoholic preparations, such as tinctures, wines, or fluid extracts. Emulsions, if properly prepared will not "crack," *i.e.*, separate into oil and water upon standing. The *National Formulary* gives the following general directions for the preparation of emulsions:

EMULSIONES (N. F.), *Emulsions.—Formulary number*, 123: "The successful formation of emulsions, whether of fixed or volatile oils, is most satisfactorily and expeditiously accomplished with acacia as the emulsifying agent. Hence, preference is given acacia in this Formulary, though other emulsifying agents are not ignored, and their use and application is exemplified in a number of alternative formulas for preparing emulsion of cod-liver oil.

A. Emulsification.—"When acacia is used as the emulsifying agent, it is important that the oil, the acacia, and the water, shall primarily be in absolutely definite proportion to each other *by weight*. This proportion is 8 parts of oil to 2 parts of acacia, and 3 parts of water. The oil (8), and acacia (2), in fine powder, are weighed into a mortar, and well mixed by trituration; the water (3), is then added *in one portion*, and the whole is triturated briskly until a thick, creamy emulsion is produced, the sides of the mortar being carefully scraped, and the mixture again triturated so as to insure the complete emulsification of all the oil. During warm weather, the water and oil should be cooled. The other ingredients may then be gradually added; first the flavoring, then the greater part of the water necessary to make the final quantity, then the syrup, etc. Finally, the quantity is adjusted by the addition of sufficient water. Alcoholic liquids should be added last, and should be previously mixed with a portion of the water. If these simple conditions and directions are carefully observed, and particularly, if the proportions by weight are accurate, a perfect emulsion is obtained with certainty and rapidity.

"With other emulsifying agents—mucilage of Irish moss, mucilage of dextrin, glycerite of egg, tincture of quillaja—the proportions need not be adjusted with the same minuteness. It suffices to place the emulsifier into a bottle or mortar, and to add the oil in small portions at a time, shaking or triturating briskly after each addition until emulsification is completed. Obviously, the preparation of this class of emulsions is very much facilitated by mechanical contrivances that are capable of producing brisk agitation and mingling of the two fluids, and such are necessarily resorted to when emulsions are to be made in large quantities for the market.

B. Flavoring.—"Since no single or compound aromatic can be devised which would be acceptable under all circumstances as a flavoring for emulsion of cod-liver oil, the selection of the most suitable aromatic must be left to the prescriber or dispenser. Among those which are found to be most serviceable are the following, the quantities given below being intended for one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of finished emulsion, though in some cases a smaller or a larger quantity, in the same proportion, may be preferable:

(1) "*Oil of gaultheria*, four cubic centimeters (4 Cc.) [65 ♏]. (2) *Oil of gaultheria*, two cubic centimeters (2 Cc.) [32.5 ♏]; *Oil of sassafras*, two cubic centimeters, (2 Cc.) [32.5 ♏]. (3) *Compound spirit of orange* (*U. S. P.*), one and one-half cubic centimeters (1.5 Cc.) [24 ♏). (4) *Oil of gaultheria*, two cubic centimeters (2 Cc.) [32.5 ♏]; *oil of bitter almond*, one-fourth cubic centimeter (0.25 Cc.) [4 ♏]; *oil of coriander*, one-fourth cubic centimeter (0.25 Cc.) [4 ♏]. (5) *Oil of gaultheria*, one and one-half cubic centimeters (1.5 Cc.) [24 ♏]; *oil of sassafras*, one and one-half cubic centimeters (1.5 Cc.) [24 ♏]; *oil of bitter almond*, one-fourth cubic centimeter (0.25 Cc.) [4 ♏]. (6) *Oil of gaultheria*, two and one-half cubic centimeters (2.5 Cc.) [41 ♏]; *oil of bitter almond*, two and one-half cubic centimeters (2.5 Cc.) [41 ♏]. (7) *Oil of neroli*, one and one half cubic centimeters (1.5 Cc.) [24 ♏]; *oil of bitter almond*, one and one-half cubic centimeters (1.5 Cc.) [24 ♏]; *oil of cloves*, one-fourth cubic centimeter (0.25Cc.) [4 ♏].

C. Preservation.—"When an emulsion of cod-liver oil is to be kept for some time, its deterioration may be prevented or retarded by the addition of sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏] of alcohol in the place of the same quantity of water, when making one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of emulsion."

EMULSUM AMMONIACI (U. S. P.)—EMULSION OF AMMONIAC.

Synonyms: *Mistura ammoniaci* (*Pharm.*, 1880), *Lac ammoniaci*, *Emulsio ammoniaci*, *Milk of ammoniac*, *Ammoniacum mixture.*

Preparation.—"Ammoniac, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Rub the ammoniac in a warmed mortar, with nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of water, at first very gradually added, until a uniform emulsion results. Then strain the mixture into a graduated vessel, and wash the mortar and strainer with enough water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description and Dosage.—A milk-like preparation, hence its name, *milk of ammoniac*, the appearance being due to the suspended resinous and oleaginous bodies, the first of which largely precipitates upon standing. Acids slightly curdle the mixture. Uses, those of ammoniac. Dose, 1 to 4 fluid drachms.

EMULSUM AMYGDALÆ (U. S. P.)—EMULSION OF ALMOND.

Synonyms: *Mixtura amygdalæ* (*Pharm.*, 1880), *Milk of almond*, *Almond mixture*, *Emulsio simplex*, *Simple emulsion*, *Emulsio amygdalæ*, *Emulsio amygdalarum.*

Preparation.—"Sweet almond, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; acacia, in fine powder, ten grammes (10 Gm.) [15 grs.]; sugar, thirty grammes (30 Gm.) [1 oz. av., 25 grs]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Having blanched the almonds, add the acacia and sugar, and beat them in a mortar until they are thoroughly mixed. Then rub the mass with nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of water, at first very gradually added, until a uniform mixture results. Strain this into a graduated vessel, and wash the mortar and strainer with enough water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the whole thoroughly"—(*U. S. P.*).

Acacia is present in this formula ostensibly for its mechanical action, but it is wholly unnecessary, as it enables no more oil to be suspended, nor does it add to the keeping properties of the emulsion. Care should be exercised to select almonds that have not become rancid. Emulsion of almond is not permanent, the oleaginous portion separating to form a creamy upper stratum. In warm weather it readily sours. Alcohol and heat cause the separation of the ingredients, while acids coagulate the albuminous matter present, thus favoring separation. Emulsion of almond has the appearance of milk, and possesses a bland taste.

Action, Medical Uses, and Dosage.—This agent is demulcent and nutritive. It may be freely used in *catarrhal disorders*, *irritated urinary passages*, and *dysentery.* It forms an agreeable vehicle for medicines not acid in character. Dose, 2 to 8 fluid ounces.

EMULSUM ASAFŒTIDÆ (U. S. P.)—EMULSION OF ASAFETIDA.

Synonyms: *Mistura asafœtidæ* (*Pharm.*, 1880), *Milk of asafœtida*, *Asafœtida mixture*, *Lac asafœtidæ.*

Preparation.—"Asafetida, in selected tears, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Rub the asafetida, in a warmed mortar, with nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of water, at first very gradually added, until a uniform emulsion results. Then strain the mixture into a graduated vessel, and wash the mortar and strainer with enough water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏].

Mix the whole thoroughly"—(*U. S. P.*). About 18¼ grains of asafetida to the ounce of water are contained in this emulsion.

Action, Medical Uses, and Dosage.—This is the best preparation of asafetida. It is also used as an enema. Dose, ½ to 1 fluid ounce.

EMULSUM CHLOROFORMI (U. S. P.)—EMULSION OF CHLOROFORM.

Synonyms: *Mistura chloroformi* (*Pharm.*, 1880), *Chloroform mixture*, *Emulsio chloroformi*.

Preparation.—"Chloroform, forty cubic centimeters (40 Cc.) [1 fl℥, 169 ♏]; expressed oil of almond, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; tragacanth, in very fine powder, fifteen grammes (15 Gm.) [231 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Introduce the tragacanth into a perfectly dry bottle of sufficient capacity, add the chloroform, and shake the bottle thoroughly, so that every part of the surface may become wetted. Then add about two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and incorporate it by vigorous shaking. Next add the expressed oil of almond, in several portions, shaking after each addition, and when the oil has been thoroughly emulsified, add enough water in divided portions, shaking after each addition, until the product measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

This preparation is preserved by the chloroform, and does not separate on standing. It contains 4 per cent of chloroform, differing in this respect from the formula of 1880, which contained 5 per cent, and in addition camphor; yolk of egg being the emulsifying medium.

Action, Medical Uses, and Dosage.—This is a convenient and stable preparation of chloroform, and may be used in the various forms of *colic*, as *uterine*, *flatulent*, *renal*, and *biliary colic*, and in *gastralgia*, *hysteria*, and other *nervous derangements*. Dose, ½ to 1 fluid ounce.

Related Preparation.—Mistura Chloroformi (*U. S. P.*, 1880). "Purified chloroform 8 parts, camphor 2 parts, fresh yolk of egg 10 parts, water 80 parts; to make 100 parts. Rub the yolk of egg in a mortar, first by itself, then with the camphor, previously dissolved in the chloroform, and lastly with the water, gradually added, so as to make a uniform mixture"—(*U. S. P.*, 1880).

EMULSIO OLEI MORRHUÆ (N. F.)—EMULSION OF COD-LIVER OIL.

Preparation.—*Formulary number*, 124: "Cod-liver oil, four hundred and sixty-four grammes (464 Gm.) [1 lb. av., 160 grs.]; acacia, in fine powder, one hundred and sixteen grammes (116 Gm.) [4 oz. av., 40 grs.]; syrup of tolu (*U. S. P.*), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; flavoring (F. 123. B), water, of each a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the oil and acacia together in a mortar. Carefully weigh out one hundred and seventy-four grammes (174 Gm.) [6 ozs. av., 60 grs.] of water, and add it *at once* to the mixture of oil and acacia, triturating briskly until a thick, creamy emulsion is produced. To this add the desired flavoring, the syrup of tolu, and enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of the finished emulsion"—(*Nat. Form.*).

Alternative Formulas.—(For flavoring see Formula 123, B. *Emulsiones*). Emulsion of cod-liver oil may also be prepared by any other method capable of emulsifying oil, the following formulas being given as examples:

Irish Moss Emulsion of Cod-liver Oil.—"Cod-liver oil, five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; mucilage of Irish moss (F. 275), three hundred and twenty-five cubic centimeters (325 Cc.) (10 fl℥, 475 ♏]; syrup of tolu (*U. S. P.*), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; flavoring (F. 123. B.), water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Pour the mucilage of Irish moss into a suitable bottle, add the cod-liver oil in divided portions, shaking well after each addition, and when a perfect emulsion is formed, add the syrup of tolu and flavoring, and lastly, enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Finally, mix the whole thoroughly together"—(*Nat. Form.*).

Glyconin Emulsion of Cod-liver Oil.—"Cod-liver oil, five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; glycerite of yolk of egg (*U. S. P.*), one hundred and seventy-five cubic centimeters (175 Cc.) [5 fl℥, 440 ♏]; syrup of tolu (*U. S. P.*), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; flavoring (F. 123, B.), water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the glycerite of yolk of egg (glyconin) in a mortar with the oil, added in small portions at a time, and thoroughly incorporate each portion before adding the next. Then, continuing the trituration, gradually add the syrup of tolu, and flavoring. Finally, add enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and mix the whole thoroughly together"—(*Nat. Form.*).

Quillaja Emulsion of Cod-liver Oil.—"Cod-liver oil, five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; tincture of quillaja (*U. S. P.*), sixty-five cubic centimeters (65 Cc.) [2 fl℥, 394 ♏]; syrup of tolu (*U. S. P.*), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; flavoring (F. 123, B.), water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Pour the tincture into a suitable bottle, then add the cod-liver oil in portions of about one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏] each, and shake after each addition until a perfect emulsion results. Next add the syrup of tolu, and the flavoring, and lastly, enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Finally mix the whole thoroughly together. An 85 per cent emulsion of cod-liver oil may be prepared by mixing in the manner just prescribed: Cod-liver oil, eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏]; tincture of quillaja (*U. S. P.*), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; flavoring (F. 123, B.), syrup of tolu (*U. S. P.*), of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—Emulsion of cod-liver oil made with quillaja should not be dispensed without the direction or consent of the prescriber"—(*Nat. Form.*).

EMULSIO OLEI MORRHUÆ CUM HYPOPHOSPHITE (N. F.)—

EMULSION OF COD-LIVER OIL WITH HYPOPHOSPHITE.

Preparation.—*Formulary number*, 129: "Cod-liver oil, four hundred and sixty-four grammes (464 Gm.) [1 lb. av., 160 grs.]; acacia, in fine powder, one hundred and sixteen grammes (116 Gm.) [4 ozs. av., 40 grs.]; any soluble hypophosphite, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; syrup of tolu (*U. S. P.*), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; flavoring (F. 123, B.), water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Emulsify the oil with the acacia and one hundred and seventy-four grammes (174 Gm.) [6 ozs. av., 60 grs.] of water, as directed under *Emulsio Olei Morrhuæ* (F. 124), and add the flavoring. Then dissolve the hypophosphite in sufficient water, mix this solution with the syrup, and add the mixture gradually to the emulsified oil. Lastly, add enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and mix the whole thoroughly. *Note.*—If several hypophosphites are required, equal parts of them may be used, amounting altogether to seventeen and one-half grammes (17.5 Gm.) [270 grs.] for the above formula. Varying quantities, larger or smaller than the above, may of course, be used upon prescription"—(*Nat. Form.*).

EMULSIO OLEI RICINI (N. F.)—EMULSION OF CASTOR OIL.

Preparation.—*Formulary number*, 131: "Castor oil, thirty-two grammes (32 Gm.) [1 oz. av., 56 grs.]; acacia, in fine powder, eight grammes (8 Gm.) [123 grs.]; tincture of vanilla (*U. S. P.*), two and one-half cubic centimeters (2.5 Cc.) [41 ♏.]; syrup (*U. S. P.*), twenty cubic centimeters (20 Cc.) [325 ♏]; water, a sufficient quantity to make one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Carefully weigh the castor oil and the acacia into a mortar, triturate until well mixed; carefully weigh out twelve grammes (12 Gm.) [185 grs.] of water, and add *at once* to the mixture of oil and acacia, triturating briskly until a thick, creamy emulsion is produced. To this add gradually, with stirring, a mixture of the syrup and tincture with a portion of the remaining water, and finally enough water to make one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. The emulsion contains about one-third (⅓) of its volume of castor oil. The flavoring may be varied to suit prescription. It should be freshly prepared as required"—(*Nat. Form.*).

EMULSIO OLEI TEREBINTHINÆ (N. F.)—EMULSION OF OIL OF TURPENTINE.

Preparation.—*Formulary number*, 132: "Oil of turpentine, twelve and one-half cubic centimeters (12.5 Cc.) [203 ♏]; acacia, in fine powder, two grammes (2 Gm.) [31 grs.]; yolk of egg, fifteen cubic centimeters (15 Cc.) [243 ♏]; aromatic elixir (*U. S. P.*), fifteen cubic centimeters (15 Cc.) [243 ♏]; cinnamon water (*U. S. P.*), a sufficient quantity to make one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Triturate the acacia with the yolk of egg, then add the oil of turpentine very slowly, continuing the trituration, and finally add the aromatic elixir, and enough cinnamon water to make one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏], in the same manner"—(*Nat. Form.*).

Emulsion of oil of turpentine, or any *volatile oil*, may also be prepared according to the following general formula: "Volatile oil, twelve and one-half cubic centimeters (12.5 Cc.) [203 ♏]; acacia, in fine powder, six grammes (6 Gm.) [93 grs.]; syrup, twenty-five cubic centimeters (25 Cc.) [406 ♏]; water, a sufficient quantity to make one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Pour the volatile oil into a dry bottle, and, having corked the latter, agitate it so that the inner surface may be completely wetted by the oil. Then add the acacia, and shake again. Finally add the syrup, and enough water to make one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏], and mix thoroughly. *Note.*—If this general formula is applied to emulsion of oil of turpentine, and a product similar to that obtained by the first formula is desired, the syrup should be replaced by aromatic elixir, and the water by cinnamon water. If a so-called "emulsion" of a volatile oil is to be made more permanent, this may be accomplished by incorporating with it a small portion of some bland fixed oil, such as expressed oil of almond. Usually, 1 volume of the fixed oil will be sufficient for 2 volumes of the volatile oil. In this case the mixture should be made in a mortar, by trituration, and under observation of the rule laid down in general formula for emulsions (F. 123)"—(*Nat. Form.*).

ENEMATA.—CLYSTERS.

SYNONYMS: *Injections*, *Enemas*, *Lavements*, *Clysteria*, *Clysmata*.

Injections are medicinal agents in the form of infusion, decoction, or mixture, designed to be passed into the rectum, vagina, urethra, bladder, etc. Sometimes pulverized ingredients are added to those intended for the rectum. They are usually thrown into the rectum to remove *constipation*, to allay *inflammation of the lower intestines*, to remove *ascarides*, to stimulate or nourish the system, to produce an influence upon distant organs by sympathetic action, as to occasion emesis, perspiration, uterine action, etc., and as a revulsive. When, from any cause whatever, medicines or liquid food can not be administered by mouth, they may be used in the form of a rectal injection, in about double the quantity required when taken into the stomach; though some care is necessary in proportioning the dose of powerful medicines. When an evacuation of the bowels is designed, as in *bilious colic*, *apoplexy*, *convulsions*, *constipation*, etc., the quantity of fluid should be large, 1 or 2 pints for an adult, repeating it every 10, 20, or 30 minutes, until the object is effected. Children will require reduced amounts, according to their ages and susceptibilities. When it is desired to make an impression upon distant or neighboring parts, or upon the rectum itself, or to produce a constitutional influence, the injection should be given in as small an amount of fluid as is consistent with its activity or character, and should be held within the rectum as long as possible; and if the patient can not retain it, a warm compress of linen or muslin may be pressed upon the anus with a moderate degree of firmness, by the nurse, which will prevent the enema from being immediately evacuated.

Injections into the vagina are intended to aid in restoring the normal condition of its walls, to assist in the cure of *excoriation* or *ulceration of the cervix*, to remove *vaginal leucorrhœa*, to produce a sedative influence upon the uterus, to induce premature delivery, etc. Uterine injections are designed to remove a low grade of *inflammation of its mucous lining membrane*, to cure *ulceration in the canal of the cervix*, to stimulate the organ to activity, etc. Urethral injections are to relieve *inflammation of the urethra or bladder*, to check *chronic discharges from the urethra*, heal *ulceration of the bladder*, stimulate the mucous lining membrane of the urethra, and the prostate gland, etc. Injections into other parts are usually for the purpose either of removing foreign or unhealthy matters, allaying inflammation, or stimulating the parts to increased action. Very salutary effects are frequently obtained in this way, better than it is possible under certain conditions to procure by administration of remedies by mouth. Many ingenious instruments at present are contrived for the administration of injections.

Injections are a valuable mode of treatment in many diseases; indeed, some affections can not be readily nor permanently cured without them. They are found especially beneficial in *bilious colic*, in *bilious*, *typhus*, *yellow*, and *congestive forms of fever*, in *dysentery* and *diarrhœa*, etc. In infants, life has often been preserved by their timely application, and the pains and dangers of the parturient woman have frequently been very materially lessened by their use. And yet, notwithstanding their value and importance, there are hundreds of families, especially in country places, who do not supply themselves with the articles necessary for their administration, but who depend entirely upon the physician, or perhaps a neighbor, for the use of a syringe. This is a very reprehensible omission, and, although not exactly within the province of this work, yet, from the evil results which I have seen depending upon a negligence of the above character, I can not refrain from making a few brief advisory remarks. Every individual, and more especially every family, is liable to sickness which may require the use of a syringe, and to depend upon the physician for its supply is certainly bad policy, for very few, especially those practicing in the country, furnish themselves with a quantity sufficient to meet the demands of the various families under their professional care; besides, very few physicians carry an article of this kind, and, in some diseases, the delay occasioned by sending for it may be death to the patient. No doubt, an immense number of patients, and more particularly among those residing in the country, die yearly, solely from the want of an instrument with which to administer an injection. It is, therefore, a matter of duty with the practitioner, both to himself and to his patients, to strongly impress these facts upon those who patronize him professionally, and urge them by all means to make the necessary provisions. A rubber or metallic syringe, capable of holding a pint, and a smaller one of 3 or 4 fluid ounces, and a rubber bulb and tube syringe, or a fountain syringe, should be found in possession of every family, as these can be adapted to meet any emergency requiring their use.

Injections are emollient, stimulant, anodyne, purgative, antispasmodic, etc., and are most generally prescribed by the physician to suit the emergency of the case, without regard to official directions. For purposes of nutrition, as well as to reduce inflammation of the lower intestines, infusions of starch, of elm bark, of flaxseed, and of cornmeal, are usually injected into the rectum, with a portion of laudanum added when inflammation is present; and in cases where the stomach rejects all food and medicine, and when this condition is accompanied with prostration, a proper quantity of wine, brandy, or some similar stimulant, may be added to the nutrient clyster, and repeated as often as the circumstances require (J. King). The following enemata are among the agents of this class in more common use:

ENEMA ALOES, *Enema of aloes.*—Mix and rub together 40 grains of aloes, 15 grains of potassium carbonate, and 10 fluid ounces of mucilage of starch. This accords with the *Br. Pharm.* Uses same as for *Enema Aloes Composita*, which see.

ENEMA ALOES COMPOSITA, *Compound enema of aloes, Compound clyster of aloes.*—Take of aloes 40 grains, carbonate of potassium 15 grains, tincture of asafetida 3 fluid drachms, infusion of boneset ½ pint. Mix and rub them together. This is a stimulant, cathartic, and vermifuge clyster, and may be used with advantage for the removal of *ascarides* from the rectum; also in *constipation*, especially among females laboring under *amenorrhœa* (J. King). For the purpose of inducing catharsis large amounts should be used; for the destruction of ascarides, and to stimulate local parts, small quantities are preferable.

ENEMA CATHARTICUM, *Cathartic enema, Cathartic clyster.*—Take of common table salt ½ troy ounce, olive or castor oil 1 fluid ounce, molasses 2 fluid ounces, warm water 2 pints. Mix together. This is a very common laxative clyster, the ingredients of which are generally to be procured readily in every family. The above quantity is intended for an adult; it may be given at once, or be divided into 2 equal parts, to be used within 10 or 15 minutes of each other. It is generally employed in cases of *constipation*, or where a speedy evacuation of the bowels is desired. An injection is sometimes used for the above purposes, and in *diarrhœa* and *dysentery*, and, indeed, in almost every case where an enema is indicated, composed as follows: Take of sweet milk ½ pint, infusion of elm bark ½ pint, olive oil 2 fluid ounces, molasses 4 fluid ounces, bicarbonate of potassium ½ troy ounce. Mix. When there are pains and gripings in the lower intestines, laudanum ½ fluid drachm may be added to each injection (Beach's *American Practice*).

Enema Lobeliæ Composita, *Compound enema of lobelia*, *Compound clyster of lobelia*, *Antispasmodic clyster*.—Take of water ½ fluid ounce, compound tincture of lobelia and capsicum ½ fluid drachm. Mix together. This is a relaxant and antispasmodic clyster, and is used in cases of *tetanus*, *convulsions*, *rigidity of the os uteri*, and whenever its peculiar actions are indicated. The proportions, as given in the above formula are adapted to an infant from several weeks to a year old, laboring under an attack of convulsions; for adults, ½ fluid ounce or even more of the tincture, may be added to a sufficient quantity of water, and so in proportion (J. King).

Enema Magnesii Sulphatis, *Enema of magnesium sulphate*, *Enema catharticum*.—Dissolve 1 ounce (av.) of magnesium sulphate in 15 fluid ounces of mucilage of starch, add 1 fluid ounce of olive oil, and mix. This accords with the *Br. Pharm.* This enema is of value in *cerebral congestion* where a derivative effect is desired and as an evacuant in *obstinate constipation*. Large amounts should be used. A simple solution of magnesium sulphate without the other ingredients would be just as effective.

Enema Opii, *Enema of opium*, *Clyster of opium*, *Enema sedativum*, *Enema anodynum*.—Take of decoction of starch, or infusion of elm bark 1 fluid ounce, tincture of opium 20 minims. Mix them. The *Br. Pharm.* directs tincture of opium ½ fluid ounce, and mucilage of starch 2 fluid ounces. This clyster is useful in *irritation* or *inflammation of the bladder*, *uterus*, or *prostate gland*, in *obstinate emesis*, in the passage of *renal calculi*, in *nephritis*, in *dysentery*, and in *painful affections of the large intestines*. It may sometimes be necessary to double or treble the quantity of tincture of opium named in the formula. It should be retained in the rectum as long as possible, and may be repeated every 1, 2, or 3 hours, and in severe cases even oftener, according to the urgency of the symptoms. If frequently employed it will produce the constitutional effects of the opium.

Enema Tabaci, *Enema of tobacco*.—Infuse in a closed vessel for 30 minutes, 20 grains of leaf tobacco in 8 fluid ounces of boiling water (*Br. Pharm.*, 1867). This enema is designed to produce nausea and consequent muscular relaxation in cases of *strangulated hernia*, *ileus*, *fecal accumulations*, and other *bowel obstructions*, to induce alvine evacuations. It must be carefully used. It has been used in *tetanus*, and for the destruction of *ascarides*. Not more than 1½ ounces of this preparation should be employed at one injection.

Enema Terebinthinæ, *Enema of turpentine*.—Mix 1 fluid ounce of oil of turpentine with 15 fluid ounces of mucilage of starch. This accords with the *Br. Pharm.* Of value in *tympanitic distension of the intestines* when confined to the colon. Also used to destroy *ascarides*, and in *hysteria* and *amenorrhœa*, and is said to give marked relief from the *pain* produced by the presence of *vesical calculus*.

Enema Terebinthinæ Composita, *Compound enema of turpentine*, *Compound clyster of turpentine*.—Take of castor oil ½ fluid ounce, oil of turpentine 2 fluid drachms, camphorated tincture of opium 1 fluid drachm. Mix together. This injection is principally employed in *flatulency*, and *tympanitic distension of the abdomen*, especially during an attack of *peritonitis*. It may be repeated 2, 3, or 4 times a day. It may likewise be used in *ascarides*, *obstinate constipation*, and *amenorrhœa*.

EPIGÆA.—TRAILING ARBUTUS.

The leaves of *Epigæa repens*, Linné.

Nat. Ord.—Ericaceæ.

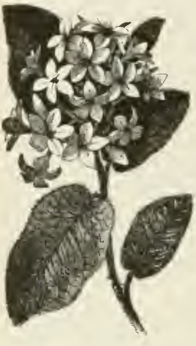
Common Names: *Trailing arbutus*, *Winter-pink*, *Gravel-weed*, *Gravel plant*, *Mountain-pink*, *Ground laurel*, *May-flower*.

Botanical Source.—This is a small trailing plant, indigenous, with woody stems from 6 to 20 inches long, and covered with a hairy pubescence in all its parts. Its leaves are evergreen, alternate, cordate-ovate, entire, 2 or 2½ inches long, by 1½ wide, roundish at the end, abruptly tipped with a very short point, and borne on slender petioles. The flowers, which are very fragrant and white, or tinged with various shades of red, are disposed in small axillary clusters on short stalks. The corolla is hypocrateriform, tube cylindrical, longer than the calyx, hairy within; limb 5-parted and spreading. The calyx is green, 5-parted, with 3 large bracts at base; stamens 10, with filiform filaments; anthers oblong, awnless, dehiscent by two longitudinal openings. The capsule or pod is depressed, globular, 5-lobed, 5-celled, and many-seeded (W.—G.). According to Mr. Thomas Meehan, this is a diœcious plant.

History.—This shrubby little plant grows in sandy woods, sometimes in rocky soil in the shade of pines, and is found from Newfoundland to Northwest Territory and Michigan, and south to Kentucky and Florida. Its flowers exhale a rich, spicy fragrance, and appear from March to May. It is much sought in early spring, and admired by flower lovers for its modest beauty and fragrance. Cattle that chew this herb are said to be seriously affected by it. The leaves which have an astringent, bitterish taste, are the medicinal parts, and yield their properties to water or spirits.

Chemical Composition.—Trailing arbutus contains tannin, as shown by Jefferson Oxley (*Amer. Jour. Pharm.*, 1872, p. 253). He also observed a body giving some of the test reactions for gallic acid, but differing from the latter in not yielding pyrogallol by dry distillation. Mr. Oxley also found formic acid and the following principles, which also occur in Uva ursi, which see: The glucosid *arbutin* ($C_{12}H_{16}O_7$), *urson* ($C_{20}H_{32}O_2$), and the very bitter glucosid *ericolin* ($C_{34}H_{56}O_{21}$) or, according to Thal ($C_{26}H_{30}O_3$). Grape sugar, gum, and coloring matter were found in addition to the constituents mentioned.

Fig. 103.



Epigæa repens

Action, Medical Uses, and Dosage.—Trailing arbutus specifically influences the urinary organs. It is diuretic and astringent. This is a very valuable American remedy, and is highly beneficial in *lithic acid gravel*, and all *diseases of the urinary organs* attended with *vesical irritation;* it is superior to uva ursi, or foreign buchu, and where these have failed in producing benefit, this has succeeded. It may be used as a substitute for uva ursi. It renders the urine less irritating, and will be found of value to control *vesical tenesmus*, *dysuria*, and *strangury*. A discharge of bloody muco-pus is an indication for its exhibition. The fluid extract and specific epigæa are elegant preparations for all urinary difficulties. It enters into a very useful preparation termed *Diuretic compound*, which see under the head of *Infusions*. It has been occasionally used with advantage in *diarrhœa*, and *bowel complaints* of children. The infusion of the leaves may be drank freely. Dose of specific epigæa, 10 to 30 drops in water every 2 to 6 hours; fluid extract, 10 to 40 drops.

Specific Indications and Uses.—Uric acid deposits; irritable vesical membrane; voiding of urine containing blood or muco-pus; debilitated and relaxed bladder.

EPIPHEGUS.—BEECH DROPS.

The whole plant of *Epiphegus virginiana*, Barton (*Epiphegus americanus*, Nuttall; *Orobanche virginiana*, Linné).

Nat. Ord.—Orobanchaceæ.

COMMON NAMES: *Beech-drops*, *Cancer-root*.

ILLUSTRATION: Meehan's *Native Flowers and Ferns*, Vol. II, p. 93.

Botanical Source.—This plant is the *Epiphegus americanus* of Nuttall, the *Orobanche virginiana* of Linné, and is also known by the name of *Cancer-root*. It is a parasitic growth, with a smooth, fleshy, leafless stem, about 1 or 1½ feet in height, with slender and irregular branches given off along its whole length. The root is scaly, tuberous, and covered with stiff, short, and brittle radicles. Instead of leaves it has only a few scattered, inconspicuous, ovate scales, one at the base of each branch, of a yellowish or purplish color. The flowers are alternate, scattered on each branch, subsessile, the lower perfect and fertile, the upper usually imperfect and abortive. Calyx short and 5-toothed. Corolla of the perfect flowers 2-lipped; upper lip emarginate, lower 3-toothed; of the imperfect, slender, 4-toothed, deciduous, 6 to 8 lines long, curved, whitish, and purple; upper tooth or lip broadest, notched at the apex, arched not longer than the others. The stamens are as long as the corolla; the filament smooth; the anthers 2-lobed, acute at the base; valveless and dehiscent in the middle. Stigma capitate, somewhat emarginate. Capsule gibbous, truncate, oblique, 1-celled, compressed, half 2-valved at the apex, with 2 approximate placentæ on each. The seeds are very numerous, straw-colored, shining (L.—W.—G.).

History and Description.—This plant is found throughout North America, parasitic upon the roots of beech trees, and flowering in August and September. The whole plant has a dull-red color, without any verdure. It has a disagreeable, astringent, and amarous taste, much lessened by desiccation. It yields its virtues to water. There are several other species of this genus, which are parasitic, and which possess analogous properties, as the *Aphyllon uniflorum*, Gray (*Orobanche uniflora*, Linné), or *One-flowered* or *Naked broomrape*, and the *Conopholis americana*, Wallroth (*Orobanche americana*, Linné), or *American broomrape*, *Squaw-root*, or *Cancer-root*.

Action, Medical Uses, and Dosage.—An astringent. Used with benefit in *hemorrhages* of the bowels and uterus, and in *diarrhœa*. Said to cure *cancer*, but it possesses no property of the kind. In *erysipelas*, a decoction drank freely, and the parts bathed with it, has effected many cures. As a local application, the decoction or poultice will arrest the tendency of *wounds* or *ulcers* to *gangrene;* a poultice of equal parts of poke, white oak, and beech-drops is very useful in *herpetic affections*. Also useful as a topical application to *obstinate ulcers*, *aphthous ulcerations*, *leucorrhœa*, *gleet*, etc. The homœopaths extol it in *headaches* brought on by fatigue and journeys. This plant seems to exert an influence upon the capillary system, somewhat similar to that produced by the tincture of chloride of iron. Dose of the powder, from 10 to 15 grains. The decoction may be drank freely.

EPILOBIUM.—WILLOW HERB.

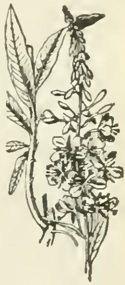
The leaves and root of *Epilobium angustifolium*, Linné, and *Epilobium palustre*, Linné.

Nat. Ord.—Onagraceæ.

Common Names: I. *Epilobium angustifolium*—*Willow herb*, *Great willow herb*, *Rose-bay*, *Wickup*. II. *Epilobium palustre*—*Marsh epilobium*, *Wickop*, *Swamp willow herb*.

Botanical Source.—*Epilobium angustifolium*. This plant, sometimes known as *Rose-bay*, is the *Epilobium spicatum* of Lamarck; it is a perennial, indigenous plant, with a simple, erect stem from 4 to 6 feet in height. The leaves are scattered, lanceolate, sessile, smooth, subentire, with a marginal pellucid vein, from 2 to 5 inches in length, and one-fourth as wide. The flowers are large, numerous, very showy, pink-purple, and in a long terminal spike or raceme. The corolla has 4 deep, lilac-purple petals, clawed, and widely spreading. The calyx-tube is not prolonged beyond the ovary; the limb is 4-cleft, 4-parted, and deciduous. Stamens 8, and as well as the style, turned to one side. The stigma has 4 linear, long, revolute lobes. The ovary and capsule are long, linear, 4-cornered, 4-celled, and 4-valved; and the seeds numerous with a tuft of long hairs (W.—G.). *Epilobium palustre* has a terete, branching, somewhat hirsute stem, growing from 1 to 2 feet in height, sessile, lanceolate, or linear, entire or subdenticulate, smooth leaves, attenuate at base, rather acute, alternate; lower ones opposite, and from 1 to 3 inches long, and one-third as wide. The flowers are small, numerous, axillary, rose-colored, or purplish, and in the narrow-leaved variety (var. *albidum*), white. The petals are small, obcordate, twice longer than the calyx; style included; stigma clavate; capsules 1 or 2 inches long, not over $\frac{1}{8}$ of an inch in diameter, borne on short pedicels, and pubescent.

Fig. 104.



Epilobium angustifolium.

History and Chemical Composition.—*Epilobium angustifolium*, when in bloom is a conspicuous feature of our landscape, from July to September. It grows plentifully from Pennsylvania northward, and to some extent in the mountainous districts of North Carolina, and from thence westward and northward. Like *fireweed* (*Erechtites hieracifolia*), it may be found growing in one place one year, and the next year may disappear therefrom, and reappear in a new situation several miles distant. In some localities, however, it is almost constant, coming year after year in the same spot. This plant is known by various names, the best known of which are *willow herb*, *wickup*, and *rose-bay*. In contradistinction to other species known likewise as wickup and willow herb, it is called *great willow herb*. Willow herb is a perennial, growing along waysides, railroads, along the fences of pasture lands, as well as in new ground recently cleared by burning. Mr. C. J. Biddle found the root of Epilobium angustifolium to contain mucilage, tannin, starch, sugar, resin, and a crystalline calcium salt (*Amer. Jour. Pharm.*, 1877). Several species of epilobium are indigenous, *Epilobium palustre* or swamp epilobium being valued as possessing similar medicinal virtues to the plant in question. The roots of epilobium possess some activity, but the leaves are preferred. They yield their virtues to water or alcohol.

Epilobium palustre, or *Swamp willow herb*, grows in swamps and marshes from Pennsylvania to Arctic America, and westward to Oregon.

Action, Medical Uses, and Dosage.—Epilobium has never attained a place in the front rank as a medicine. This is often the case with drugs that have not decided poisonous properties, or with such drugs as have not yielded to the chemist an active principle. That it has not attained prominence as a remedy is not the fault of the plant, for in certain cases of *summer bowel troubles* it is without an equal. The infusion is probably the best form of administration, though alcoholic preparations are not without remedial activity. Specific epilobium is a reliable preparation. The infusion is not unpleasant, its taste being somewhat like that of tea. Epilobium is tonic, astringent, demulcent and emollient. The uses given for it are many, but we would particularly allude to its value in *summer bowel complaints*. It has a deserved reputation in *chronic diarrhœa*, and it has been known to give better service than other remedies in diarrhœas following, or dependent in the first place on "*camp* or *army diarrhœa*." The infusion should be freely used. Several cases of *diarrhœa* of a watery character, due to change of drinking water, have been promptly checked by the infusion or the tincture. Certain forms of *cholera infantum*, especially with greenish discharges of undigested aliment, have been controlled by this agent in domestic practice, where the ordinary remedies prescribed by the physician failed to have any beneficial effect. It is prominent as a remedy for *muco-enteritis*. Administered in very small doses it has proven effective in a large number of cases of *typhoid dysentery*. With Prof. Scudder, infusion of epilobium was a favorite remedy to correct and restrain the *diarrhœa of typhoid or enteric fever*. In this particular condition others attest its efficacy. It is a good remedy in *intestinal irritation*, as a wrong of intestinal digestion. It is indicated here by the pinched features, emaciation, and the slick, contracted tongue, the papillæ being somewhat effaced. It is further indicated in bowel troubles by impairment of digestion with uneasy sensations in the abdomen, amounting to pain, accompanied by diarrhœa and having the above symptoms of bowel irritation.

An infusion of the leaves will be found beneficial in *leucorrhœa*, *menorrhagia*, and *uterine hemorrhage;* and forms an excellent local application for *ophthalmia*, *ulcerations of the mouth* and *throat*, and *leucorrhœa*. The leaves in poultice are a valuable remedy for foul and indolent *ulcers*. Dose of the infusion, sweetened if desired, from 2 to 4 fluid ounces, 5 or 6 times a day, or smaller doses may be repeated every 10, 20, 30 or 60 minutes as required.

Epilobium palustre, marsh epilobium, wickop, or swamp willow herb, is said to be a valuable article in *colic* and in *irritable conditions of the intestines;* in severe *dysentery*, *camp diarrhœa*, formerly known as "*Mexican diarrhœa*," and *cramp of the stomach*. In fact it acts similarly to willow herb. It has proved quite successful in some very severe cases of colic and dysentery, even after the failure of other agents. Prof. J. M. Scudder extols this plant very highly in the above diseases, and also in *ulceration of the bowels* attending *typhoid fever*, as it quiets irritation, gradually checks diarrhœa, and relieves tenderness and tympanitis. He prescribes a tablespoonful every hour of an infusion made by infusing an ounce of the herb in ½ pint of boiling water. The dose of specific epilobium ranges from 10 to 60 drops. The infusion may be freely used.

Specific Indications and Uses.—Prof. Scudder gives the following specific indications: "Diarrhœa, with colicky pain; feculent discharges with tenesmus; diarrhœa, with contracted abdomen; chronic diarrhœa, with harsh, dirty, contracted skin." Diarrhœa of typhoid fever; typhoid dysentery.

Related Species.—*Epilobium hirsutum*, Linné; *Great hairy willow herb*, *Fiddle-grass*, *Codlins-and-cream*. Adventive from Europe, and found in waste places in eastern New England, Ontario, central New York, and in the ballast near seaports (Britton and Brown). Dr. Oliver (see *Amer. Hom.*, 1897, p. 442) reports the case of a three-year-old boy, poisoned by eating Epilobium hirsutum. The symptoms were profound coma and recurring epileptiform convulsions.

EQUISETUM.—SCOURING RUSH.

The plant *Equisetum hyemale*, Linné.

Nat. Ord.—Equisetaceæ.

COMMON NAMES: *Scouring rush*, *Horse-tail*, *Shave-grass*.

Botanical Source.—This is a perennial plant, with simple, stout, erect, jointed, and hollow stems, marked with from 14 to 26 longitudinal furrows, the ridges rough with 2 rows of minute tubercles, growing from 2 to 3 feet in height, each stem bearing a terminal, ovoid spike. Frequently 2 or more stems are united at the base from the same root. The sheaths are from 2 to 3 lines long, from an inch to an inch and a half apart, ashy-white, black at the base and summit, short, with subulate, black, awned, deciduous teeth, which leave a bluntly crenate margin The fertile plants are mostly leafless. The fruit is placed under peltate polygons, being pileus-like bodies, arranged in whorls, forming a spike-like raceme, from 4 to 7 spiral filaments surround the spores, which resemble green globules, and which roll up closely around them when moist, and uncoil when dry (G.—W.)

History and Chemical Composition.—This plant is common to the northern and western parts of the United States, growing in wet grounds, on river banks, and borders of woods, and maturing in June and July Together with other *Cryptogamia*, this species abounds in the fossil remains of coal measures, indicating that they were once of gigantic dimensions, and formed a large part of the original flora of our globe. Silica enters largely into the composition of these plants, on which account they have been used to scour, rough polish, etc.; 1.4 per cent of a brownish-green, semi-fluid fixed oil, easily saponifiable, was abstracted from this plant by F. J. Young, by means of petroleum benzin (*Amer. Jour. Pharm.*, 1886, p. 420) The plant left 18.2 per cent of ash, and proved to be free from tannin, alkaloid, or glucosid. Mucilage, sugar, and a soft, green resin were shown to be present. The *equisetic acid* of Braconnot was found by Regnault to be identical with *aconitic acid*. The whole plant is medicinal, and imparts its properties to water.

Action, Medical Uses, and Dosage.—Diuretic and astringent. An infusion (℥ij to aqua Oj) drank freely, has been found beneficial in *dropsy*, *suppression of urine*, *hematuria*, *gravel*, and *nephritic affections;* and has also been used with advantage in *gonorrhœa* and *gleet* This drug has a specific action in *irritation of the bladder*, and in *dysuria* with tenesmic urging, in the *nocturnal urinal incontinence* of children, and in urinal incontinence, the effect of cystic irritation, it is a very serviceable remedy. The infusion or the decoction of the green stalks is preferred. The ashes of the plant are very valuable in *dyspepsia* connected with obstinate *acidity of the stomach*, and may be given alone, or combined with powdered rosin, or hydrochlorate of berberine, etc. Dose of the pulverized ashes from 3 to 10 grains, to be repeated 3 or 4 times daily. The fresh juice may be given in 1 or 2 ounce doses, administered in water. Specific equisetum, 5 to 60 drops

Specific Indications and Uses.—Cystic irritation; nocturnal urinal incontinence; tenesmic urging to urinate; dropsy; renal calculi.

Related Species. *Equisetum lævigatum*, Braun, and *Equisetum robustum*, Braun, of the southern and western borders of our country, may be substituted for the above.

Equisetum arvense, Linné; *Common horse-tail.*—Canada to Kentucky and Virginia. This species puts forth its sterile stems after the appearance of the fertile ones. It has the medicinal uses of Scouring rush.

ERECHTITES.—FIREWEED.

The entire plant and oil of *Erechtites hieracifolia*, Rafinesque (*Senecio hieracifolius*, Linné).

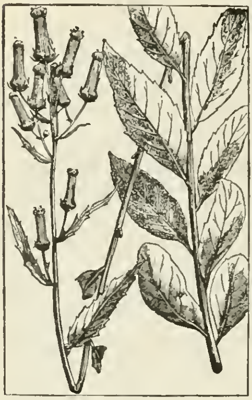
Nat. Ord.—Compositæ.

COMMON NAME: *Fireweed*.

ILLUSTRATION: Lloyd's *Drugs and Med. of N. A.*, Vol. II, Plate 38.

Botanical Source.—This plant is the *Senecio hieracifolius* of Linnæus. It has an annual herbaceous, grooved, thick, fleshy, branching, virgate panicled, and roughish stem, from 1 to 5 or even 8 feet high. The leaves are simple, alternate, large, lanceolate or oblong, acute, unequally and deeply toothed with acute indentures, sessile, and light-green; the upper ones often have an auricled clasping base. The flowers are greenish, or about the same hue as the plant, terminal, crowded, and destitute of rays. The involucre is smooth, large, tumid, and bristly at the base. The achenia are oblong and hairy (W.—G.).

Fig. 105.



Erechtites hieracifolia.

History and Description.—This is an indigenous, rank weed, growing in fields throughout the United States, in moist woods, and in recent clearings, especially and abundantly in such as have been burned over, hence its vernacular name *Fireweed*. From the fact of its brittleness and consequent liability to be easily broken, it is seldom found where animals graze. It flowers from August to October, and resembles in appearance the sow-thistle (*Sonchus oleraceus*); the flowers somewhat resemble those of lettuce. The whole plant is medicinal, and yields its virtues to water or alcohol. It has a peculiar, aromatic, and somewhat fetid odor, very unpleasant to many persons, and a peculiar, slightly pungent, bitterish, rather disagreeable taste, with some astringency. The leaves, which are most generally employed, when dried are almost black, and by this characteristic, as well as by form, may be distinguished from those of *Erigeron canadense*, or *Erigeron annuum*, with which they are sometimes confused. The former plant is often erroneously called *Fireweed*. Erechtites is often incorrectly spelled *Erechthites*.

Chemical Composition.—The properties of Fireweed appear to reside in a volatile oil (see *Oleum Erechtitis*), which may be obtained from the plant by distillation with water, and which possesses in an eminent degree the taste and odor of the plant, and which is very persistent

Action, Medical Uses, and Dosage.—Fireweed is reputed to be emetic, cathartic, tonic, astringent, and alterative, of which the most valuable are the latter three. Reputed an unrivaled medicine in diseases of the mucous tissues of the lungs, stomach, and bowels. A spirituous extract of the plant has been highly recommended by Dr. A. R. Wyeth, of Pennsylvania, in the treatment of *cholera* and *dysentery*, in the latter disease promptly arresting the muco-sanguineous discharges, relieving pain, and effecting a speedy cure. In the *summer-complaint of children*, he has found it to prove almost invariably successful, even in cases where other means had failed.

Prof. Roberts Bartholow, at the instance of the authors of *Drugs and Medicines of North America*, experimented physiologically and therapeutically with true oil of fireweed. He found it to possess the general characteristics of the antiseptic group. It proved to be non-irritant to the stomach, and rather to improve the appetite and digestion. On account of its stimulating effects upon the gastro-intestinal glands, and probably upon the pancreas, an abundant secretion is poured out, rendering the alvine evacuations easy, frequent, and copious, thus proving very useful in *habitual constipation*, and especially benefiting such cases with acid fermentation and flatulence. He states that "in *membraneous enteritis*, an affection difficult to cure, it has seemed to be, in a high degree, useful." It first stimulates the heart, dilates the arterioles, and sends a glow of warmth throughout the body. Secondarily, perspiration ensues, the sense of warmth is succeeded by a lowering of temperature, slowing of the pulse, and contraction of the arterioles. Following this is a rise in vascular tension. It is rapidly diffused, absorbed quickly, and quickly excreted, elimination taking place most largely by the lungs, and less so by the kidneys and skin. He concludes that its most important therapeutical action is in disorders of the parts by which it is eliminated, as *chronic bronchitis*, *pulmonic affections*, with catarrh of the air tubes, *chest neuroses*, and *coughs* of local origin. It may also be used by inhalation. Benefit was derived from its use in *genito-urinary catarrh*, *pyelitis*, *gleet*, *cystitis*, etc., the drug also allaying nervous irritability. Prof. Bartholow further suggests its value in "*sciatica*, *muscular rheumatism*, and cognate affections."

Prof. Hale, on part of the Homœopaths, gives quite a list of the effects of the oil in tincture, in large doses, and concludes that its action is chiefly upon the vascular system. As oil of fireweed upon the market is generally oil of fleabane, it is very probable that the product used by the Homœopaths has been the erigeron oil. However, oil of erechtites is considered useful in *passive hemorrhages* from the kidneys, whether due to "*Bright's disease*" or other renal disturbances. It has been used also, like oil of erigeron, in *epistaxis*, *hemoptysis*, *hæmatemesis*, *profuse menorrhagia*, and *hemorrhage from the bowels*. According to Hale large doses will increase the menses and bring them on early if used continuously in cold, torpid, phlegmatic individuals. It is a remedy for *gonorrhœa*, *gleet*, and *gonorrhœal orchitis*. (See *Oleum Erechtitis*.) Dose, 5 to 10 drops of the oil upon sugar, in emulsion, or in capsules.

Specific Indications and Uses.—Catarrhal states of the mucous membranes; passive hemorrhages; "albuminuria, dropsy, pale, waxy skin, swelling of feet, scanty urine" (Watkin's *Comp. of Ec. Med.*).

ERGOTA (U. S. P.)—ERGOT.

SYNONYM: *Ergot of rye*.

"The sclerotium of *Claviceps purpurea* (Fries), Tulasne (*Class:* Fungi), replacing the grain of rye, *Secale cereale*, Linné (*Nat. Ord.*—Gramineæ). Ergot should be only moderately dried. It should be preserved in a close vessel, and a few drops of chloroform should be dropped upon it from time to time to prevent the development of insects. When more than one year old, it is unfit for use"—(*U. S. P.*).

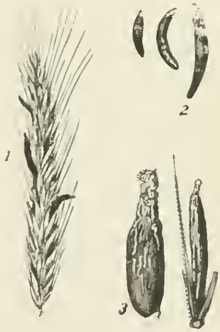
Nat. Ord.—Fungi—Ascomycetes.

SYNONYMS: *Spur*, *Spurred rye*, *Smut rye*, *Ergot of rye*.

History and Formation.—Ergot is the sclerotium, the second, intermediate, or dormant stage of *Claviceps purpurea* (Fries), Tulasne, a fungus replacing the grain of rye (*Secale cereale*, Linné). *Ergot*, or *spur*, as it is sometimes called, was formerly regarded as a diseased grain of rye, but as now understood the grain of rye is simply replaced with the fungous growth. No *transformation* occurs as was supposed, but the tissue of the caryopsis of the rye is *destroyed* (*Pharmacographia*).

Ergot has been the subject of much investigation, particularly at the hands of Léveillé, Meyen, Tulasne, and others. De Candolle (1816), believing with others that ergot was a distinct and complete fungus, named it *Sclerotium Clavis*, while Fries denominated it *Spermœdia Clavus*. Queckett called it *Ergotætia abortifaciens*, and Berkley, *Oidium abortifaciens*. Tulasne, however, placed it in the genus *Claviceps*, as an ascomycetous fungus, of which he described 3 species—one of which, the *Claviceps purpurea*, grows on rye, wheat, oats, and numerous pasture grasses. For a long period the ergotized condition of the rye was confounded with other and somewhat similar conditions met with in other cereals and in the fruits of sedges and grasses—parasitic maladies of crowded herbaceous plants growing side by side, year in and year out, in the same localities. The affection of the rye has been more thoroughly studied than some of those in other plants, probably on account of the former general use of rye as a food and the terrible consequences of epidemics of gangrene that have been traced to the contaminated grain, and also from the fact that it is one of the most important of medicinal substances.

Fig. 106.



1. Ear of rye with Ergot.
2. Ergot.
3. Ergotized rye

The generic name of the fungus, now recognized as the causative factor in the production of ergotized rye, is *Claviceps*, and is derived from the club-headed receptacles bearing the fructifications; the specific name, *purpurea*, refers to its purplish hue. The intermediate stage of the fungus is designated the *sclerotium*, *spur*, or *ergot*. *Sclerotium* signifies a hardened body, and *ergot*, derived from a French word (*argot*, a cock's spur), has reference to the spur-like shape of the sclerotium. The effect of the *Claviceps*, or fungus, is to *apparently* change the young fruit into an elongated, purplish-black, hard body which projects from the fruiting head of rye. This body is subcylindrical, curved, tapers bluntly at each extremity, and is an inch or more in length. Its outer surface is dark, being purple-black, while its interior is white and felt-like, being, in fact, "a densely compacted mass of fungus mycelium" (spawn, or branching network of *hyphæ*, which latter are thread-like bodies or cells, having a protective membrane of cellulose inclosing protoplasm). Besides the protoplasm the mycelium cells contain about 35 per cent of oily food materials. The dark, spur-like body is the *ergot*, and Léveillé, a French botanist, was the first to show it to be an aggregation of mycelium at rest and not, as formerly supposed, a diseased grain.

Tulasne (1852), desirous of learning the fate of these bodies (ergot) after leaving the host plant (the rye), instituted experiments which led to the determination of the true character of ergot and the fungus of which it is a part. He began his experimentation by sowing a number of the sclerotia (ergot), and these, after remaining at rest upon damp earth for several months, began to put forth from their surfaces little nodules or hillocks which, by lengthening, formed rod-like projections (stipes) of thick, white material, capped at the free extremity with plump, rounded expansions or heads (*stroma*) of a violet color. At first these club-like projections were thought to be distinct parasites, but were later proven to be mere expansions of hyphæ growing out from the mycelium cells constituting the sclerotium, and pushing their way from their point of origin in the pale-white interior through the thin-purple coat. In time the surface of the little purple head or stroma was found to have developed minute papillæ, or wart-like projections, each presenting a minute orifice at its apex. The opening led directly into an ovoid cavity, directly below the papillæ, known as the *perithecium* (*conceptaculum*). Subsequently there arose from the base of this ovoid cavity (*perithecium*) long, thin, tubular bodies, denominated *asci* or *thecæ* (*spore-sacs*), as well as other asci in various stages of development. Inasmuch as the orifice of the papillæ leads vertically downward into the perithecium, the asci, whose long axes are also vertical to the surface of the stroma, point toward the orifice in the papillary elevation. Within each of these asci there are long, slender, thread-like bodies without color, and from 6 to 8 in number, termed *ascospores*. As these silky-white flocculent spores ripen they are shed as an agglutinated mass through the small orifices of the papillæ by the bursting of the *asci*, and are then carried about by insects, rains, winds, and like agencies. This usually takes place at about the same time that the cereals are beginning to blossom. If now the ascospores come in contact with the young flower of the rye, the latter is infected in the following manner, the result being that the mycelium takes possession of the base of the pistil. At various points the ascospores swell, and at these swellings give rise to small, slender branchlets, which quickly bore through the epidermis at the base of the flower. In about 10 or 12 days the lower portion of the flower is found to have been invaded by the mycelium, the slender, colorless hyphæ of which soon project from the surface and envelop the young pistil in complex folds. From the tips of the hyphæ, which terminate these folds, there "buds off" enormous numbers of very minute, colorless bodies, termed *conidia*, and at the same time the folds secrete a malodorous but viscid and sugary fluid of a yellowish color, which repels bees, but attracts flies, beetles, ants, etc., and is popularly known as the "*honey dew*." This saccharine fluid, in which are immersed the conidia, sticks to the proboscides, feet, and other parts of the visiting insects, and is thus carried to healthy flowers, where the conidia, in contact with the young flowers, behave exactly as do the ascospores—germinating and penetrating the pistil-base and developing in it a mycelium exactly like that produced by the latter, and which, in a few days, produces new conidia and fresh honey dew, thereby establishing a new source of infection.

The white mycelium and the honey dew with its contained conidia, constitutes what was formerly known as the *sphacelia*, a term indicative of the shrivelled gangrenous appearance of the tissues attacked. After the production of conidia and honey dew has progressed for several days, the pistil which normally would have developed into the grain, becomes a dead, shrivelled mass. The fact has already been referred to that the mycelium, which gives origin to the conidia and honey dew, has penetrated the floral base and pistil, forming in their tissues a dense, white felt-work. This now becomes more and more compact and increases in quantity, while the outer cells become first dark in color and then hard in texture, thereby developing the *sclerotium of the fungus*—the *ergot*, which, as its growth progresses and it becomes an elongated, spur-like body, carries before it the shrivelled, dead remains of the pistil and the sphacelia, which gave origin to the conidia. Thus the ergot matures just previous to the time for harvesting the rye and then drops off, rests upon the ground through the winter and early spring months, and in the summer germinates, and thus the ravages of the previous season are repeated. In this way it may go on for years, producing its sphacelia and developing its ergot parasitically upon the host plant, and then, after resting on the soil through the winter, it saprophytically develops its stromata upon the ergot-form or sclerotium.

It will be observed from what has been narrated, that the life history of Claviceps presents 3 stages of development: (1) The development of the sphacelia, with its conidia and honey dew; (2) the dormant state of the compact mycelium of the fungus, or the produced *ergot;* (3) the fructification of the ergot exhibited in the germination of the ergot-form producing the stromata, perithecia, asci, and ascospores. The ergot, therefore, is but the intermediate or resting stage of the development of this interesting fungus (*Claviceps purpurea*). The major portion of the preceding popular description of the formation of ergot was prepared from H. Marshall Ward's *Diseases of Plants.*

Ergot should be gathered previous to harvest, and is said by M. Bonjean to be much more active after the fifth day of its formation. When we examine a number of ears of ergotized rye, we find that the number of grains on each spike which have become ergotized varies considerably; there may be one only, or the spike may be covered with them. Usually the number is from 3 to 10. The mature ergot projects considerably beyond the paleæ. It has a violet-black color, and presents scarcely any filaments and sporidia. Ergot is met with in all climes where cereals are grown, the bulk of the commercial product coming from Vigo, in Spain and Teneriffe, while considerable quantities are furnished by southern and central Russia (see *Pharmacographia*).

Description.—Ergot of commerce consists of grains which vary in length from a few lines to 1 inch, or even 1½ inches, and whose breadth is from ½ to 4 lines. Their form is cylindrical or obscurely triangular, with obtuse angles, tapering at the extremities (fusiform), curved like the spur of a cock, unequally furrowed on two sides, often irregularly cracked and fissured. The odor of a single grain is not detectable, but of a large quantity is fishy, peculiar, and nauseous. The taste is not very marked, but is disagreeable and very slightly acrid. The grains are externally purplish-brown or black, more or less covered by a bloom, moderately brittle, the fractured surface being tolerably smooth, and whitish or purplish-white. Their specific gravity is somewhat greater than that of water, though, when thrown into this liquid they usually float at first, owing to the adherent air. The lower part of the grain is sometimes heavier than the upper (P.). When ergot is examined under the microscope, its internal part is seen to be composed of minute hexagonal or rounded cellular tissue, the cells containing from 1 to 3 globules of oil; its violet or blackish coat consists of a layer of longitudinally elongated delicate cells, and its blooms consist of sporidia. Unless kept carefully excluded from the air, it softens and swells, and becomes infected with numerous brown insects, about the size of a pin's head, while at the same time it acquires a deep-black color and heavier odor. Its powder quickly becomes damp, and full of animalcules. It should always be used recently pulverized, or, if kept in powder, it should be in well-closed and darkened vials, and with a few lumps of camphor added. It imparts its virtues to water or alcohol; long boiling renders it inert. The best ergot is dry, and easily broken, free from insects, burns with a clear flame, and is incapable of forming a dark-blue pulp when its powder is triturated with iodine and water.

The *U. S. P.* requires that ergot should conform to the following description: "Somewhat fusiform, obtusely triangular, usually curved, about 2 or 3 Cm. (¾ to 1¼ inches) long, and 3 Mm. (⅛ inch) thick, 3-furrowed, obtuse at both ends, purplish-black, internally whitish with some purplish striæ, breaking with a short fracture; odor peculiar, heavy, increased by trituration with potassium or sodium hydrate T.S.; taste oily and disagreeable. Old ergot, which breaks with a sharp snap, is almost or entirely devoid of a pinkish tinge upon the fracture, is hard and brittle between the teeth, and is comparatively odorless and tasteless, should be rejected"—(*U. S. P.*). The *U. S. P.* directs the occasional addition of a few drops of chloroform to ergot to prevent the development of insects.

Chemical Composition.—Vauquelin is generally accredited with having made the first analysis of ergot of rye, but according to his own statements, a chemical analysis of ergot had been made by Model, of Strassburg, as early as 1766 (*Jour. Pharm. Chim.*, 1817, p. 164). Subsequent researches have brought out the most contradictory results, owing not only to the changeable character and the want of crystallizability, of the physiologically active drug constituents, but also to the tendency of various investigators to apply identical names to essentially different bodies, as well as to persistently uphold distinctions by name of substances that are essentially alike, if not identical. As a result, opinions are still divided, as to the chemical nature of the substances that constitute the active principles of ergot. Indeed, it seems as if this drug acts, as a whole, in a way that no constituent or mixture of products can do. At one time it was believed that the *fatty oil* which occurs in ergot in the amount of from 25 to 30 per cent, and upward, carried the medicinal properties of the drug, a belief probably due to the fact that the oil when obtained by expression or extraction with ether may hold in solution some of the active principles of ergot (*ecboline*). However, it was found that by abstraction, with petroleum ether, or with benzin, no ecboline will pass into the fatty oil (J. Denzel, *Archiv. der Pharm.*, 1884, p. 314). The name *ergotin* has been applied to different substances by different authors. Wiggers (*Prize Essay*, 1831), extracted dried ergot, which had been previously deprived of its fatty oil by means of ether, with boiling alcohol, and after evaporating the solvent he treated the residue with water, which left the "ergotin" (*Chemisches Centralbl.*, 1832, p. 276). The *ergotin* of Bonjean (1843), was merely an aqueous extract of ergot purified by separating out gummy and albuminous matter by means of alcohol (*Amer. Jour. Pharm.*, Vol. XV, p. 219). W. T. Wenzell, in 1864, isolated from ergot, as he supposed, two alkaloids, *ecboline* and *ergotine*, which later investigators (*e. g.*, Blumberg, 1878), pronounced identical. Ecboline possessed the physiological action of ergot to a powerful degree. Both alkaloids he found combined in the drug with a peculiar acid which he called *ergotic acid*. Besides he observed a volatile constituent, *propylamine*, which he pronounced identical with the volatile *secaline* previously observed by F. L. Winckler (1852). Walz established the presence of the volatile base, *trimethylamine*, which Brieger (1887) showed to be a product of decomposition of *cholin*, one of the constituents of ergot.

Tanret, since 1875, maintains that the active principle of ergot is represented by a crystallizable alkaloid which he called *ergotinine*, having the formula $C_{35}H_{40}N_4O_6$. Amorphous ergotinine he obtained as a by-product. Dragendorff and Podwissotzky (1876), observed the ecbolic principle of ergot to reside in two non-alkaloidal substances which they named *sclerotic acid* and *scleromucin*. The former, existing in good ergot in the amount of from 4 to 4.5 per cent, is soluble in alcohol of 80 per cent and less; the latter is soluble in alcohol of 40 per cent and less, both are soluble in water, and are difficult to obtain free from ash. If these substances are really the active principles of ergot, it becomes evident why it is not admissible to remove gummy and albuminous matter by the addition of an excess of strong alcohol. In this connection see the interesting papers by C. Lewis Diehl, and by Prof. Hallberg, in *Amer. Jour. Pharm.*, 1881 and 1883. Dragendorff and Podwissotzky, investigating also the coloring matters of ergot, found *sclererythrin*, *sclerojodin*, *scleroxanthin*, and *sclerocrystallin*, to which they added, in 1877, *picrosclerotine* (a poisonous, evanescent alkaloid, perhaps identical with Tanret's *ergotine*, etc.), and *fusco-sclerotic acid* (see *Jahresb. der Pharm.*, 1876–77).

In 1884, R. Kobert concluded from his researches that ergot contained three active principles, two of acid nature and one an alkaloid. *Ergotic (ergotinic) acid*, a glucosid containing nitrogen, is the principal constituent of *sclerotic acid* aforementioned, also of Bonjean's ergotin, and of the ergotin of Wernich, which he obtained by dialysis. It has the power of paralyzing the spinal cord, but does not produce ecbolic action. *Sphacelic (sphacelinic) acid* is a resin free from nitrogen, probably the main constituent of the ergotin of Wiggers. It produces gangrene. *Cornutine*, an exceedingly poisonous alkaloid, according to Kobert is not identical with Tanret's ergotinine. Denzel (1884), however, believes it to be identical with Wenzell's *ecboline* which, in turn he thinks to be the same substance as Tanret's ergotinine; likewise he believes the acid principles, ergotic acid (Kobert), sclerotic acid (Dragendorff), and ergotic acid (Wenzell), to be identical. In 1894, C. C. Keller pronounced the identity of his *cornutine* with Tanret's *ergotinine*, Dragendorff's *picrosclerotine*, and Kobert's *cornutine*, on the ground that they all gave the same color reaction with concentrated sulphuric acid (a few mgr. of alkaloid first colored the acid yellowish, and after a few hours a permanent violet blue). Keller also gave directions for the assay of ergot for cornutine (see *Proc. Amer. Pharm. Assoc.*, 1895, p. 542, and A. R. L. Dohme, *ib.*, p. 263). Within the last few years (since 1895), Dr. C. Jacoby's researches have come to the front. In his latest experiments he strove to exclude the deleterious action of water, alkalies, and temperatures above 60° C. (140° F.), hence the substances he obtained have a just claim on our attention.

In 1895, the firm of C. F. Boehringer introduced Jacoby's *spasmotin* or *sphacelotoxin*, as a most active educt from ergot (*Pharm. Centralhalle*, 1895, p. 265). In 1897, however, Jacoby observed that this substance was not a simple body, but was composed of three chemically different substances, *chrysotoxin*, *secalintoxine*, and *sphacelotoxin* proper. The latter forms the basic principle of the others, and the relation is as follows: Sphacelotoxin + (inert) secalin = secalintoxine; sphacelotoxin + (inert) ergochrysin = chrysotoxin. Sphacelotoxin is a resin free from nitrogen, and combines the gangrenous with the uterine contractile action of ergot. Secalintoxin acts qualitatively like chrysotoxin, only the gangrenous action is more apparent on account of the greater tendency of the former to decomposition; hence the latter substance is preferred pharmacologically. In both cases sphacelotoxin, by decomposition in the organism, becomes the active principle. The mode of preparation and description of these bodies have recently appeared in print (*Pharm. Centralhalle*, 1898, p. 185), and may be summarized as follows: *Chrysotoxin* is a phenol-like body, also obtainable in crystalline form, having the composition $C_{21}H_{22}O_9$. It is prepared by depriving powdered ergot of its fat by means of petroleum ether, abstracting with strictly absolute ether, evaporating the solution to a syrup and precipitating with petroleum ether. By redissolving in ether and fractionally precipitating with petroleum ether, pure chrysotoxin is obtained. This substance is insoluble in water, diluted acids, and petroleum ether; soluble in ether, chloroform, alcohol, benzene, glacial acetic acid, etc. Caustic alkalies form golden-yellow solutions that are altered by warming. Prolonged contact with excess of alkali converts it into inert *ergochrysinic acid*, precipitable by acids. This is probably a constituent of Kobert's *sphacelinic acid*. Chrysotoxin is administered in the form of its sodium compound.

Secalintoxine is a pronounced alkaloid contained in the first fractions in the preparation of chrysotoxin. The impure chrysotoxin is dissolved in ether, the alkaloid shaken out with diluted acetic acid, and precipitated by means of sodium carbonate. In pure form it is soluble in alcohol, acetic ether, chloroform, benzene, less soluble in ether, little soluble in water and weak alkalies, and insoluble in benzin and petroleum ether. With concentrated sulphuric acid it gave Keller's *cornutine* reaction, without being identical with this substance, as both differ markedly in their physiological actions. Evaporated on the water-bath repeatedly with alcohol and concentrated hydrochloric acid, traces of the alkaloid leave a beautiful violet-colored residue. *Ergochrysin* is a yellow, inert coloring matter, soluble in water and in glacial acetic acid. *Secalin* is obtainable, in crystals of several millimeters in length, from secalintoxin. It is a pronounced alkaloid, yet stated to be not identical with Kobert's *cornutine*, nor Tanret's *ergotinine*, as it does not possess the contractile activity of the latter. It gives the color reaction of secalintoxine in a more pronounced degree, and exhibits a beautifully blue fluorescence in alcoholic solution. It has the formula $C_{29}H_{55}N_6O_{14}$. *Sphacelotoxin* is obtained as a yellow resinous mass which soon turns greenish, by precipitating with petroleum ether an ethereal solution of secalintoxine. Crystals of secalin are also formed. Decomposition of *secalintoxine* into its components, secalin and sphacelotoxin, is best effected by means of lime. It contains traces only of nitrogen, and gives but faintly the secaline reaction above mentioned.

Other Constituents of Ergot.—Among these may be mentioned vegetable albumen (Wiggers, 1831); ash (5 per cent, especially rich in phosphates); acetic, lactic, and formic acids, probably occurring in decomposed ergot only; *cholesterin*, recorded by Schoonbrodt (1863), though Tanret (1889) considers it peculiar to ergot, naming it *ergosterin*. It is probably identical with the substance that Wiggers, in 1831, named *cerin* (see Wiggers, *Jahresb. der Pharm.*, 1869, p. 25). *Leucin* (amidocapronic acid) *mannit*, and reducing *sugar*, are also present in ergot. Wiggers observed a sugar peculiar to ergot, which was non-reducing and not readily fermentable. It was called *mycose* by Mitscherlich, and thought to be identical with *trehalose* by Muntz. Mucilage is present in ergot in appreciable amount. A peculiar, crystallizable body, *vernin* ($C_{16}H_{20}N_8O_8+3H_2O$), discovered by E. Schulze and Von Planta, and found to occur in various plants, associated with asparagin, has also been observed in ergot (see *Jahresb. der Pharm.*, 1886, p. 15).

In conclusion it may be said that nowithstanding the voluminous literature on this subject and the patient work devoted to the chemistry of ergot, much remains yet to be done when it comes to affiliating the chemical record and the therapeutical constituents. It is evident, as before stated, that in therapy such preparations as liquids containing natural groups of constituents, made by methods that do not use heroic chemistry, are as yet the logical preparations to be used by conservative physicians.

Detection of Ergot in Flour, Bread, etc.—Ergot may be detected when mixed with farinaceous substances, by the following method of M. Wittstein: Mix the suspected substance with a little water in a test tube, and cover with a layer of solution of caustic potash—if ergot be present, trimethylamine is disengaged, which has an unmistakable odor of fish-brine; the application of heat favors the development of this substance, but likewise quickly dissipates it. By simply mixing the bread or flour containing ergot with milk of lime and allowing it to stand for some time, the odor just described becomes apparent.

Flückiger (*Pharmacognosie*, 3d ed., 1891), favors Hilger's color test, which is carried out as follows: Shake 10 grammes of the flour suspected of containing ergot with 20 grammes of ether and 10 drops of diluted sulphuric acid (sp. g. 1.11), allow to stand for 6 hours, filter, and wash with sufficient ether to collect 20 grammes of filtrate. Add 10 drops of a solution of sodium bicarbonate saturated in the cold, and shake; the red violet coloring matter, due to the presence of ergot, will then appear in the lower (aqueous) layer. The test gives good results even with 1 gramme of flour containing only 1 per cent of ergot. The color reaction remains permanent for weeks. For further chemical and some microscopical tests, see Flückiger. To distinguish *fresh* from *old* ergot, Koster (*Amer. Jour. Pharm.*, 1885, p. 241), recommends macerating for some time 2 Gm. of the powder with 5 Cc. of ether. The resulting solution is colorless if the ergot is fresh, but yellowish if it is old.

Action, Medical Uses, and Dosage.—I. Ergot. Ergot exerts a remarkable effect on the human system, more especially when its use has been persevered in for some time. Its most serious influences are those occasioned by the continued use of affected rye as food, and which are manifested by certain symptoms termed *ergotism*, which assumes two types—*convulsive ergotism* and *gangrenous*. These two forms do not present well-defined pathological differences, though they differ in termination. The first form is characterized by weariness, giddiness, muscular contraction, formication, dimness of sight, voracious appetite, loss of sensibility, yellow countenance, convulsions, and death. The second is likewise accompanied by formication, voracious appetite, insensibility, and gangrene (either moist or dry) of the extremities, with dropping off of the toes. In doses of from 30 to 60 grains, and especially when the stomach is in an irritable condition, it frequently causes vomiting and nausea. When given in large doses, it is apt to affect the cerebro-spinal system, as known by restlessness, heaviness of the head, headache, vertigo, enlarged pupils, tinnitus aurium, and other symptoms of narcotism, with depressed heart and respiratory action, and gastro-intestinal irritation with sudden nausea and vomiting. These effects have been termed *acute ergotism*. It frequently lessens the action of the heart and arteries, though sometimes this is increased, with febrile symptoms, especially during parturition. A single dose, varying from 2 to 8 drachms, has occasioned vomiting, colic, pains, and headache; single doses of 20 to 40 grains have no great influence under ordinary circumstances.

The exact physiological action of ergot is still a matter of investigation, but the view chiefly held is that it acts mainly upon the vascular and nervous systems, as follows: Microscopic examinations of the retina, spinal and cerebral meninges, and of the frog's foot, show its power to contract the arterioles. Ergot depresses the heart and dilates the veins, the effect of which is a deficient supply of blood to the arteries, causing an inactive contraction or in reality an arterial collapse. To this result is due its effects upon the nervous structures, causing an anemia of the cerebro-spinal axis and ganglionic centers and of the organic muscular structures. The primary effect of ergot on the circulation is a fall in blood pressure, but its ultimate effect is to induce a rise in blood pressure.

The effects of ergot are not fully produced by the many so-called active principles of ergot. The action of ergotin, however, most closely resembles that of the parent drug. It has been shown by Köhler that Wiggers' ergotin has no effect upon the circulatory apparatus, but may induce intestinal cramps and violent gastro-intestinal inflammation, while Bonjean's ergotin is free from such effects, and slows the heart, contracts the arterioles, lessens temperature, and diminishes reflex phenomena. In very large doses the latter paralyzes the heart, and the muscular tissues fail to respond to the galvanic current. Ergotic acid is thought to be the active ingredient of Bonjean's ergotin. It must be used hypodermatically, as it is destroyed in the stomach. It undoubtedly has hemostatic power, but does not cause uterine contractions. *Sphacelic acid* and *cornutine* (chiefly the latter), are thought to be the effective agents in the induction of uterine contractions, and to the former have been attributed the gangrenous effects of ergot.

Ergot does not readily kill in a single large dose, fatal effects, when occurring, being developed from the long-continued use of small doses. A teaspoonful of tincture of ergot, taken 3 times a day for 11 weeks, was alleged to have caused the death of a woman 3 months pregnant. The only post-mortem features were inflammatory patches on the gastric mucous membrane (Taylor, *Med. Juris.*, p. 522). The treatment for acute ergotism is chiefly symptomatic. Cardiac stimulants, as caffeine, coffee, etc., or amyl nitrite by inhalation, may be employed. The hot bath and dry heat increase the effects of the medicinal treatment.

Medicinally, ergot is chiefly used on account of its power of promoting uterine contraction in *languid natural labors*. When thus employed, it produces a strong, continued, and, as it were, spasmodic contraction of the uterus, seldom permitting any relaxation until the child is born, and often continuing for some minutes after. The contractions and pains caused by ergot are distinguished from those of natural labor by their continuance; scarcely any interval can be perceived between them, but a sensation is experienced of one continued forcing effort. Sometimes ergot causes no unpleasant effects on the system; and likewise fails to excite uterine contractions, which will be found the case with other parturient agents. The causes of these failures are not known, being merely conjectural. It is said that ergot poisons the child and causes its death. This may, probably, sometimes be the case, but I am induced to believe that the fatality more generally ensues in consequence of the long-continued and constant pressure of the contracted organ upon the cord and fetus, causing its utero-fetal circulation to cease, and thus destroying it by asphyxia (J. King). In support of the view that ergot probably does not directly operate in a poisonous manner upon the child, may be cited the testimony of Uvedale West (see Taylor, *Med. Juris.*, p. 521), who administered ergot during the births of 173 children, only 5 of whom were still-born. In a state of pregnancy, ergot will undoubtedly occasion abortion, though it sometimes fails here likewise. However, many contend that it is incapable of producing abortion, but that it is effectual only after uterine contractions have already commenced—that, while it is an ecbolic it is not an abortifacient. It also influences the non-gravid uterus, producing painful contractions or bearing-down pains, and on this account has been useful in checking *menorrhagia*, *uterine hemorrhage*, and in expelling *polypus masses*.

As a parturient, its use should always be avoided, if possible, in first labors, nor is it to be used in the early stage of normal labor. In our opinion there are but two chief indications for the use of ergot in labor, and these are *uterine inertia* and *alarming hemorrhage*, and as the latter is most frequently post-partum, a full hypodermatic injection of Lloyd's ergot should be given as soon as the head is born, when hemorrhage threatens. The conditions for safety and success are that the labor be somewhat advanced, the mouth of the womb being moderately dilated, that no mechanical obstruction to delivery exists, as deformity of the pelvis, rigidity of the os uteri, mal-presentation, or, disparity of the size of the child to the parts of the mother, and more especially that the only cause of the slow progress of labor is insufficiency of the uterine contractions in point of force or frequency. One or 2 drachms of the powder may be stirred in 4 fluid ounces of hot water, and, when sufficiently cool, may be given in teaspoonful doses every 10 minutes until labor pains are induced; usually in 15 or 20 minutes the labor pains increase in force and frequency, and gradually become continuous, and effect the expulsion of the child within an hour. A good fluid extract of ergot, or Lloyd's ergot (non-alcoholic), are equally as efficient as crude ergot. To simply increase labor pains already existing not more than 5 drops, every 20 or 30 minutes are required; when speedy expulsion is sought, the dose should be 1 fluid drachm, by mouth or hypodermatically, every half hour or hour. When to be used simply to facilitate labor which is slowly progressing, the following was advised by Prof. J. M. Scudder: ℞ Specific ergot, flʒi; water, fl℥ij. Teaspoonful every half hour or hour. Such doses exert a stimulant influence, strengthen uterine contractions, and aid dilatation of the os uteri. The cases usually calling for these doses are those with feeble circulation, puffiness of the face, and œdematous feet. If the os uteri be rigid, thick, and doughy, lobelia should be associated with it.

In cases where the child is dead, and circumstances require prompt delivery, as, where the patient is greatly exhausted, or where the system becomes very irritable, etc., ergot may be administered, provided there be no obstruction to a safe delivery. It may likewise be administered to facilitate *abortion* when it has once commenced, as well as to check *uterine hemorrhage* in the gravid or non-gravid state. It may likewise be given for promoting the expulsion of a *mole*, *hydatids*, *a clot of blood*, or other uterine contents, when the womb has once begun to act. The practice of administering ergot to cause the expulsion of the placenta is not to be commended, for some of the worst cases of placental retention, especially when the placenta is adherent, have been caused by the constant contraction produced, thus imprisoning the secundines until septic consequences have ensued. It is far better to remove the placenta by mechanical means, and then to use ergot in case hemorrhage of any consequence follows. Neither do we approve of the custom of administering to every parturient, at the close of labor, a dose of ergot. If there is a history of hemorrhage at or after previous confinements, or present indications of such an accident, or there is uterine inertia, such a procedure is permissible and often imperatively demanded. But where no hemorrhage occurs the imprisonment of placental tissues and other debris, as well as the increased severity of the after-pains that usually occur, are a sufficient protest in themselves against the indiscriminate employment of a remedy so productive of harm as ergot. Ergot should never be administered unless there be present or impending complications imperatively demanding its exhibition.

Ergot is an admirable remedy for *hemorrhage*, post-partum or otherwise. For this purpose ergotin (see below) is also frequently employed. It is useful in *epistaxis*, *hematemesis*, *hematuria*, *menorrhagia*, from large, spongy, subinvoluted womb, especially in scrofulous subjects, and in *intestinal hemorrhage*. It is sometimes useful in the hemorrhages accompanying *typhoid fever*. It is particularly useful, combined with appropriate constitutional treatment, in a *hemorrhagic diathesis*. It has given good results in *hemorrhagica purpura*. *Dysentery*, with bloody evacuations, has been relieved by it, and given internally or applied by suppository, it has given relief in *hemorrhoids*. It forms an excellent adjunct in the treatment of *passive hemoptysis*, the following having proven very serviceable in our hands: ℞ Specific ergot, tincture of cinnamon (oil), and specific lycopus, aa fl℥ij. Mix. Sig. Dose, 20 drops, in water, every hour until relieved. If the hemorrhage be active, 60 drops may be given every half hour. Prof. Locke advises (*Syllab. of Mat. Med.*, p. 386), the following at one dose, to be repeated every half hour if necessary: ℞ Specific ergot, gtt. x; ipecac, grs. ss; gallic acid, grs. ij. Mix. He advises the same in *post-partum hemorrhage*, and in *intestinal hemorrhage from typhoid fever*. The action of ergot is enhanced by the conjoint administration of specific geranium, gallic acid, hamamelis, cinnamon, or lycopus. For the hemorrhage from *cancerous growths*, Prof. Locke advises the dusting of the surface with finely-powdered ergot and covering with a cloth wrung from a weak phenol solution. Ergot has given good results in *aneurism*, especially when small, and is accredited very serviceable in *dilated heart*, without lesions of the valves.

Ergot has a decided action of the muscular fibers of the bladder. Large doses may contract the fibers so as to cause retention of urine. In *incontinence of urine* and other bladder affections due to relaxation of the sphincter vesicæ, specific ergot in doses of from 10 to 30 drops in water, render good service. It may be combined with buchu as follows: ℞ Specific ergot, fl℥ss; specific buchu, fl℥j; simple syrup, fl℥ijss. Mix. Sig. One teaspoonful 3 or 4 times a day (Locke). *Cystic paralysis* is sometimes relieved by ergot, and particularly when due to over-distension of the bladder. *Amenorrhœa*, due to relaxed uterine tissues, or to congestive conditions, is relieved by specific ergot in small doses, and it is useful in *leucorrhœa*, due to similar causes. It is also a good remedy in the congestive form of *dysmenorrhœa;* here it may be associated with other appropriate remedies. As before stated, it is doubted by many whether ergot will excite uterine contractions in any instance, unless a natural movement toward such action has commenced, but, as previously remarked, there is no doubt of its influence upon the womb at other times than that of parturition. There is abundant evidence that small doses of ergot have prevented *abortion*. For *uterine subinvolution* ergot is one of the most positive of remedies. In small doses it has been recommended in *painful dysmenorrhœa*, where membraneous shreds pass off. Sometimes it has proved advantageous in *fever and ague*, but is rarely used for this purpose. The dose should range from 5 to 10 or 15 grains, or an equivalent amount of specific ergot, 3 times a day, but its use should not be persisted in too long, on account of its tendency to cause dangerous symptoms. It is not without value in *spermatorrhœa*, *gonorrhœa*, and *enlarged prostate*. Small doses relieve *false pains* associated with fullness and uneasiness of the genitalia, and *œdema* with dullness, hebetude, and tendency to coma (Scudder). In skin diseases it has had a limited use in *erythema*, *urticaria*, *prurigo*, *acne rosacea* (locally and internally) and *incipient furuncles* (locally). Locally, *seborrhœa* is well treated with the oil of ergot.

Ergot is valuable in certain forms of nervous diseases. According to Dr. Brown-Sequard, ergot diminishes the blood in the spinal cord, by causing a contraction of its blood vessels; dilates the pupil; acts more especially on the fibers of the womb and of the bladder and urethra, and appears to exert a more powerful influence on the inferior portion of the spinal cord. He suggested that it be used in the same forms of *paralysis* and *disease of the spinal cord*, as belladonna. *Bonjean's purified extract* (*ergotin*), in the dose of from 2 to 10 grains, 2 or 3 times a day, is often employed in the *spinal* and *cerebellar lesions* resulting from masturbation and sexual excesses. The nervous disorders to which ergot is adapted are those of a *hyperemic* or *congestive character*, and it is always contraindicated by anemia. It has been found particularly useful in *congestive headaches*, and particularly *migraine*, with flushed face, full pulse, and suffused eyes. Its action upon the circulation closely resembles that of belladonna, and the general indications are much the same. In any trouble, "with enfeebled capillary circulation with tendency to congestion, especially of the nerve-centers, ergot may be prescribed with advantage" (Scudder). The indications are dull, full eyes, with pupillary dilatation, fullness of the veins, slow pulse, sighing respiration and tendency to coma. With these indications it has been found very serviceable in *paraplegia*, *cerebral hyperemia*, *chronic mania*, *recurrent mania*, *epileptic mania*, *acute myelitis*, *spinal congestion*, etc. In *mental disorders*, dependent on intracranial congestion or obstruction, with bleeding from the nose, dizziness, hebetude, or headache, and tinnitus, due to intracranial miliary aneurisms, ergot appears to render efficient service.

Fluid extract of ergot, or a paste of ergotin, locally applied, has been of value in *follicular pharyngitis.* Foltz (see Webster's *Dynamical Therapeutics*, pp. 577 and 621) is a strong advocate of the use of ergot in diseases of the eye. Thus, besides the common use of the drug for *conjunctival congestion* and for the *hemorrhage following enucleation* of the globe, he advises it in the following conditions: *Superficial conjunctivitis* and *keratitis*, in *follicular conjunctivitis* (claiming it better than any other drug), *ophthalmia neonatorum*, *incipient trachoma*, *phlyctenulæ*, *pannus*, with great vascularization, and *pinguecula.* He declares it of no service in episcleritis or involvement of the deeper structures of the eye. As a collyrium, he advises Lloyd's ergot gtt. xv to xxx to sufficient water to make ½ fluid ounce. Foltz further recommends full doses (Lloyd's ergot, ½ to 1 fluid drachm) in *relaxed* or *congested retinal vessels*, *hyperemia of the optic disc*, and *hemorrhage into the vitreous humor.* In combination with boric acid he employs ergot locally by insufflation in *purulent otitis media*, with little discharge and a turgid tympanic membrane: ℞ Boric acid, ʒj; fluid extract of ergot (Squibb's), fl℥ss. Mix. Triturate until dry. Ergot has given relief in *exophthalmic goitre.* Ergot and ergotin, both locally and internally, have been very effectual in reducing *nasal hypertrophies.*

II. Ergotin.—The facility with which solution of ergotin may be employed in hypodermatic injections, its rapidity of action, and its efficiency, render it superior to any other mode of administration. *Yvon's solution* (see *Liq. Ergota*) is especially available. (*Bonjean's ergotin* may be used for the same purposes.) When it is properly made it is innocuous, and occasions neither pain nor inflammation. It has been successfully employed in *post-partum hemorrhages*, the only unpleasant symptom observed being a sudden headache with vertigo, nausea, and syncope, which passes off in a few minutes by placing the patient in a horizontal position—but no symptoms resembling those of poisoning. Its effects are better manifested in *passive hemorrhages* due to inertia or atony of the uterus. The use of this solution by subcutaneous injections has likewise been found efficient in excessive *menorrhagia*, *epistaxis*, *hemoptysis*, and other profuse and obstinate hemorrhages, as *gastrorrhagia*, *enterorrhagia*, *cerebral hemorrhage*, and in *secondary hemorrhages* following *surgical operations.* They have likewise been of service in *uterine fibroma;* the soft, vascular, hemorrhagic tumors, of rapid development during the sexual life, being more readily influenced by the ergotin; while, on the contrary, the long-standing, hard, voluminous, stationary tumors, which have formed adhesions or undergone fatty degeneration, especially with females who have reached or passed the critical age, are hardly, if at all, influenced by it. Subcutaneous injections of ergotin have also proved effective in *prostatic enlargement*, *goitre*, *prolapsus of the rectum*, *purpura hemorrhagica*, *internal aneurism*, *diabetes insipidus*, *paraplegia*, *paralysis of the bladder*, and *enlargement of the spleen*, especially when the result of malarial influences. Ergotin has a special influence upon the fibers of the smooth muscles. M. Bernard, who has given considerable attention to the subject, sums up his conclusions as follows: Subcutaneous injections of ergotin act upon hemorrhages by causing contraction of the smooth fibers of the blood-vessels, or of those of the organs enclosing them. They appear to act locally at the point where the ergotin is in contact with the tissues, but this action does not appear to be independent of the influence of the nervous system. Contraction of the smooth vascular fibers acts especially by modifying the tension of the blood; contraction of the fibers of the organs containing them acts especially by effacing their caliber—compressing them. Injections of ergotin appear to act efficiently, even in hemorrhages of organs deprived of smooth fibers, or presenting few of them in their structure, as in *gastro-intestinal hemorrhages*, *hemoptysis*, and *epistaxis.* Hemorrhages of organs in which the smooth fibers predominate; that is to say *metrorrhagia*, are almost constantly cured or ameliorated by injections of ergotin. Their influence is especially manifest in the gravid condition of the uterus, or in conditions approaching it, as *moles* and *intra-uterine fibromæ.* It is likewise very energetic when the muscular fiber of the organ is healthy, even when a portion of the organ is already destroyed, as by *cancer.* In cases of *metritis*, and especially of *fungous growths*, their influence is about null. When carefully made, and a properly prepared solution is employed, no serious symptoms result. Bartholow employed successfully the hypodermatic injection of ergotin (2 grs.) for the radical cure of *varicocele.* Seldom more than two injections were necessary. The operation is very painful, and care must be exercised not to puncture the veins, the solution simply being injected among the vessels. *Varicosities* have been similarly treated.

The dose of ergotin, by hypodermatic injection, varies according to circumstances, from $\frac{1}{6}$ of a grain to 5 grains per day. Some practitioners have even exceeded this quantity, using from 3 to 10 grains daily. The quantity of Yvon's solution of ergotin will, therefore, be from $\frac{1}{6}$ of a minim to 5 minims per day. The fractions of a minim may be made by adding water to the solution, thus: To obtain $\frac{1}{6}$ of a minim, add 1 minim of the solution to 23 minims of distilled water; 4 minims of this mixture will equal the $\frac{1}{6}$ of a minim of solution. The injections should be made in the neighborhood of the diseased parts, and be repeated, according to the circumstances, every 2, 3, or 4 days. In *uterine myoma*, M. Gerard prefers to inject directly into the uterine tissue. In *profuse hemorrhages*, from 3 to 5 or 10 minims may be used at a time, and, if necessary, may be repeated every 4, 8, or 12 hours, according to the urgency of the case, and the effect of the agent. In *enlarged spleen*, from 1 to 5 grains of ergotin have been injected daily.

The dose of ergot depends upon the conditions for which it is to be used. For rapid expulsive purposes in labor, or for active hemorrhage, the dose ranges from 5 to 30 grains, or from 5 drops to 2 fluid drachms of the fluid extract, or 5 to 60 drops of specific ergot or Lloyd's ergot. Lloyd's ergot, being non-alcoholic and representing grain for minim, is an excellent preparation for hypodermatic use. For specific purposes the dose of good fluid preparations of ergot ranges from 1 to 5 drops, seldom exceeding 10 drops. Bonjean's ergotin may be given internally to the extent of 10 grains, half that quantity being about the limit for hypodermatic use. The large doses above given are seldom required, about $\frac{1}{3}$ the stated amount being usually administered. *Tanret's ergotinine* may be used subcutaneously in doses not exceeding $\frac{1}{60}$ grain.

Specific Indications and Uses.—Uterine inertia during labor, when conditions are otherwise favorable for a safe delivery; hemorrhage due to atony, with weak pulse, cold surface, and dilated (sometimes contracted) pupils; post-partum hemorrhage (large doses); to expel loosened foreign particles from the womb; congestion or hyperemia of any part; venous fullness; mental apathy; dullness, hebetude, and tendency to coma; fullness and uneasiness of genitalia, with œdema; congestive headache; hemiplegia and paraplegia, with hyperemia or congestion; feeble circulation; hyperemic or congestive eye and ear disorders; otorrhœa, discharge slight and membrane turgid.

Other Forms of Ergot.—ERGOT OF WHEAT. This form of ergot is hand-picked in France and Italy from the wheat intended for the manufacture of vermicelli, pastes, etc. The ergots are thicker and shorter than those from rye, are said to retain their good qualities longer, and to be free from the deleterious action of the latter.

ERGOT OF OATS.—More slender than the ergot of rye. Sometimes collected to mix with the latter, or to be sold per see (Le Perdriel, *Pharmacographia*).

ERGOT OF DISS.—From *Arundo Ampelodesmos*, Cirillo. A reed grass of North Africa. It was first detected in 1842 by M. Durien de Maisonneuve, in Algeria (E. M. Holmes, *Amer. Jour. Pharm.*, 1886, p. 203). It is from 1 to 3 inches long, about $\frac{1}{10}$ inch broad, curved, or if large, spirally twisted. Resembles ergot of rye in structure, and according to Lallemand, is said to possess double the activity of that product.

Ergot-yielding Plant.—RYE. The grain of *Secale cereale*, Linné. *Nat. Ord.*—Gramineæ. Rye has a stem 4 to 6 feet high, hairy beneath the spike, in a wild state seldom over a foot high. Leaves lance-linear, rough-edged, and rough above, glaucous; lower ones, together with their sheaths, covered with a soft down. Rachis bearded on each side with white hairs. Glumes subulate, ciliated, scabrous, shorter than the florets, taken together with their awns. Outer paleæ folded up, keeled, tri-nerved, with very long awns; the 2 nerves and awns very rough. Stamens 3. Ovary pyriform, pilose. Stigmas 2 (L.—W.). The native country of rye is not positively known, though supposed to have originated about the Caucasus; at the present day it is considerably cultivated among civilized nations. Ground into fine flour it is used as an article of diet in the form of bread or mush. Rye bread is not so light-colored, nor so readily digested as wheat bread. According to Einhof, the grain consists of about 6½ per cent of meal, the balance being husk or bran, nearly 2½ per cent, and moisture. The meal consists of starch 61.07, gum 11.09, gluten 9.48, albumen 3.28, saccharine matter 3.28, husk, salts, acid, etc. (P.). Rye is frequently attacked by the parasite *Claviceps purpurea* (Fries) Tulasne, the result being the production of the fungus, *ergot*.

Rye-bread, or rye-mush, is laxative, especially to those unaccustomed to its use, and is sometimes taken to obviate *costiveness*. The dry flour allays the heat and itching of *erysipelas* and other *affections of the skin* when applied upon the affected parts. In the form of poultice it is often applied to discuss *tumors* or *swellings*, or to hasten their suppuration, when far advanced.

Green rye, when from 6 to 10 inches high, made into a salve by simmering in fresh cream, I have known to cure several most inveterate cases of *tinea capitis;* to be applied to the scalp twice a day (King).

ERIGERON.—CANADA FLEABANE.

The plant *Erigeron canadense*, Linné.

Nat. Ord.—Compositæ.

COMMON NAMES: *Colt's-tail*, *Canada fleabane*, *Scabious*, *Pride-weed*, etc.

Botanical Source.—This plant is known by the various names of Colt's-tail, Pride-weed, Scabious; also improperly called by some persons Horse-weed, Butter-weed, etc. It is an indigenous annual herb, with a high, branching, furrowed, and bristly-hairy stem, from 6 inches to 9 feet in height. The leaves are linear-lanceolate, and ciliate; the lower ones subserrate. The flowers are very small, numerous, white, and irregularly racemose upon the branches, constituting a large, terminal, oblong panicle. The involucre is cylindric; the rays minute, numerous, crowded, and short; and the pappus simple (W.—G.).

History.—This plant is common to the northern and central portions of the United States, growing in fields and meadows, by roadsides, and in waste places, flowering from June to September. The very small, inconspicuous ray-flowers, which are multitudinous, the elongated involucre, and the simple pappus, will serve to distinguish it from other plants of the same family. The whole herb is medicinal, and should be gathered when in bloom, and carefully dried. It has a feeble but pleasant odor, and a subastringent and amarous taste, with some acrimony, and yields its properties to alcohol, or water by infusion Its acridity is lessened by boiling, owing to the dissipation of its essential oil.

Chemical Composition.—Dr. Dupuy, who made an examination of the plant, found it to contain essential oil (see *Oleum Erigerontis Canadensis*), tannic and gallic acids, bitter extractive, etc. The oil is not astringent to the taste, but has a styptic influence upon the system. It is of a colorless, or pale-yellow color, gradually becoming darker-colored, and may be procured from the plant by distillation with water.

Action, Medical Uses, and Dosage.—This plant is slightly tonic, with more active diuretic and astringent properties. The infusion has been found efficient in *diarrhœa*, *gravel*, *diabetes*, *dropsical affections*, *dysuria of children*, *painful micturition*, and in many *nephritic affections*. Erigeron is extremely useful for the arrest of *capillary bleeding* from any organ liable to hemorrhage, and to arrest profuse watery secretions from the gastro-intestinal and renal tracts. For many years it has been a popular favorite to arrest *watery diarrhœa*, and for the *choleraic stage of cholera infantum*, where the evacuations gush suddenly and copiously from the child, it will be found one of the most important agents at our command. The infusion of the fresh plant freely administered, should be used, and this not only serves to check the diarrhœa, but also supplies the body with fluid, which is required to supply the loss of water occasioned by the depleting evacuations. Its use is suggested in *cholera*. The infusion may be given hot or cold, or sweetened, if desired, and will prove useful if it can be retained upon the stomach. A snuff of the powdered leaves has successfully checked *epistaxis;* while in bronchial disorders with bloody expectoration, a syrup is effective. The same may be used to allay the cough and lessen expectoration in *pulmonary consumption*. Locally, an infusion is useful in *leucorrhœa*.

On account of its constringing power over the renal capillaries it has proven of value in *hyper-urination*, as in *simple diabetes*. The infusion is very serviceable in *hemorrhages* from the stomach, bowels, bladder, and kidneys. It is useful in *metrorrhagia* when not due to retained fragments of placenta, or other foreign bodies. *Passive hemorrhages* where stimulation is required are the cases for its exhibition.

The volatile oil of Erigeron canadense acts as an astringent, and may be used as a local application to *hemorrhoids*, *bleeding from small wounds*, etc., likewise in *rheumatism*, *boils*, *tumors*, *sore throat*, and *tonsilitis*, in which it should be combined with goose-oil or some similar substance, being too acrid to use alone. Internally, it will be found useful in *diarrhœa*, *dysentery*, *hemoptysis*, *hematemesis*, and *hematuria;* from 4 to 6 drops of it on sugar, or dissolved in alcohol, and given in a little water, will be found a powerful remedy in *uterine hemorrhage* and *menorrhagia*, acting promptly and efficiently; it may be repeated every 5 or 10 minutes if required. The oil may be given in the profuse stage of *gonorrhœa*. The usual manner of administering it is in simple syrup. The plant may be given in the form of powder in doses of ½ or 1 drachm; or the infusion, which is the best form of administration, may be given in doses of from 2 to 4 fluid ounces 3 or 4 times a day, and oftener in bowel complaints; the aqueous extract is worthless, but the fluid extract may be given in teaspoonful doses. Specific erigeron, 1 to 30 drops; oil of erigeron, 3 to 10 drops.

Specific Indications and Uses.—Capillary or passive hemorrhages; "painful diseases of the kidneys and bladder, and in diseased conditions of the mucous membranes attended with free discharges" (Scudder); choleraic discharges, sudden, gushing, and watery, attended with thirst and cramping pain; hematuria, metrorrhagia, hemoptysis, epistaxis, and hematemesis.

Related Species.—*Erigeron annuum*, Persoon; *Various-leaved fleabane*, *Common fleabane*, *White-weed*. This plant, also known as *Erigeron heterophyllum*, is the *Erigeron annuum* of Persoon, and many other celebrated botanists. It is a biennial herb with a branching root. Stems from 2 to 4 feet high, thick, branching, hispid with scattered hairs, terminating in a large, diffuse, corymbose panicle of large heads. Leaves hirsute, coarsely serrate; lowest ones ovate, contracted at base into a winged petiole; stem leaves ovate-lanceolate, sessile, acute, entire at both ends, highest ones lanceolate. Flowers numerous; disk-florets yellow; ray-florets capillary, white or purplish. Pappus plainly double, the outer a crown of minute chaffy-bristleform scales; the inner of scanty capillary bristles which are deciduous, or entirely wanting in the ray. This plant is common to the United States and Europe, being a very common weed in fields and waste grounds from Canada to Pennsylvania and Kentucky, and flowering from June to August (W.—G.). Properties, constituents, and uses same as those of next species (which see).

Erigeron Philadelphicum, Linné; *Philadelphia fleabane.*—The *Erigeron Philadelphicum* is the *E. strigosum* of Willdenow, and the *E. purpureum* of Aiton. It is a perennial herb, with a slender, pubescent or hirsute, leafy stem, 1 to 3 feet high, loosely corymbed at the summit, bearing a few small heads on long, slender peduncles; root yellowish and branching. Leaves from 2 to 4 by from 6 to 9 inches, thin, with a broad midrib, oblong; lower ones spathulate, crenate-dentate; upper ones oblong-lanceolate, clasping by a heart-shaped base, subserrate. Flowers numerous; disk-florets yellow; ray-florets innumerable, very narrow, rose-purple or flesh color, twice as long as the hemispherical involucre. Pappus simple. The whole herb is pubescent. This plant is found growing in common with the preceding variety, flowering at the same period (W.—G.).

The medicinal virtues of this plant and the preceding are analogous, and they may be substituted the one for the other; they are, however, less astringent and more diuretic than the *E. canadense*. The plant should be gathered during the months of July, August, and September, or during the flowering season. They are slightly fragrant, have a subastringent, somewhat bitter taste, and yield their virtues to alcohol, or to water by infusion. Mr. F. L. John obtained from 17 pounds of the dried herb but a drachm of greenish-yellow, powerful, aromatic oil, with a disagreeable, bitter, pungent taste and sp. gr. 0.946 (*Amer. Jour. Pharm.* XXVII, 105). Diuretic, astringent, and tonic. The infusion is very efficient in *affections of the bladder and kidneys*, *dysuria*, especially of children, *painful micturition*, various forms of *dropsy*, *gravel*, and in *hydrothorax* connected with *gout*. It has also been recommended as a diaphoretic in *rheumatism*, *fevers*, *colds*, etc., and as an emmenagogue in *suppressed menstruation;* and has been used with advantage in *gout*, some forms of *cutaneous eruptions*, and *diabetes*. Dose of the infusion, from 2 to 4 fluid ounces 3 or 4 times a day.

ERIODICTYON (U. S. P.)—ERIODICTYON.

"The leaves of *Eriodictyon glutinosum*, Bentham"—(*U. S. P.*) (*Eriodictyon californicum*, Bentham; *Wigandia californica*, Hooker and Arnott).

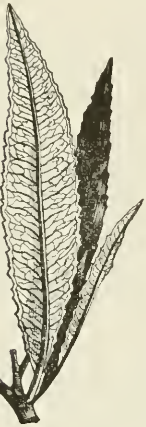
Nat. Ord.—Hydrophyllaceæ.

COMMON NAMES: *Yerba santa*, *Mountain balm*, *Consumptive's weed*, *Bear's weed*.

ILLUSTRATIONS: Hooker's *Botany*, Beech's *Survey*, Plate 88.

Botanical History and Source.—This plant is generally known as *Yerba santa* (holy or sacred herb). It is shrubby, from 2 to 4 feet high, and is found growing in clumps, in dry situations throughout California, and northern Mexico, where it is very common in certain localities. The stem is smooth, branched usually from near the ground, and covered with a peculiar glutinous resin, which exudes abundantly from all parts of the plant, excepting the under side of the leaves. The leaves are thick, leathery, and evergreen, their upper surface being coated, somewhat like a varnish, with the aforementioned resin. They are alternate, and attached by short petioles at an acute angle with the branch. In shape they are narrowly elliptical, from 2 to 5 inches long, and from ½ to ¾ of an inch in width. They are acute, and taper to a short leaf-stalk at the base. The upper surface is smooth and dark-green in color (sometimes black when dry). The under surface has a large, prominent mid-rib, and a close network of veins, and is covered, between the veins, with a close, white tomentum, which gives the surface a milky color. The margin of the leaf is dentate, with numerous unequal teeth, which are undulate and blunt. The flowers are bluish, and borne in terminal clusters, which consist of from 6 to 10 close, 1-sided racemes, that unroll as the flowers expand. The calyx is hairy, about ⅓ the length of the corolla, and deeply 5-parted, almost to the base. The corolla is broadly tubular, about ½ an inch long, and has 5 short, obtuse, spreading lobes. The 5 stamens are included in the corolla tube. The pistil consists of a free, ovate, hairy ovary, and 2 slender, diverging styles, with club-shaped stigmas.

Fig. 107.



Eriodictyon glutinosum.
½ natural size.

History.—Eriodictyon was mentioned by Prof. Maisch in March, 1875, at the meeting of the Philadelphia College of Pharmacy, a specimen of the plant being at the same time presented. The October *Eclectic Medical Journal* (1875) contained an article from Dr. J. H. Bundy, of California, upon "Yerba santa." This was followed by others, all speaking of it as *Yerba santa.* In February, 1876, Prof. J. M. Scudder received specimens of the leaves from Dr. Bundy, and immediately had them identified botanically by C. G. Lloyd. They proved to be *Eriodictyon glutinosum.* Prof. Scudder published the botanical name in the *Eclectic Medical Journal*, March, 1876, since which the plant has been generally recognized. The leaves are employed in medicine. They are fragrant even after long drying and exposure. Doubtless, oxidation or other modifications of the various resinous substances continually develops this fragrant principle, which seems not to be a volatile oil. The taste is aromatic and sweetish, eventually acrid to a slight extent, but not bitter. The after-taste is sweet, resembling dulcamara, and is accompanied by a flow of saliva.

Description.—Eriodictyon is thus described by the *U. S. P.:* "Oblong-lanceolate, 5 to 10 Cm. (2 to 4 inches) long, acute at the apex, and below narrowed into a short petiole, the margin sinuately toothed to nearly entire; upper surface green, smooth, and covered with a brownish resin; lower surface reticulate and minutely white-tomentose; odor somewhat aromatic; taste balsamic and sweetish"—(*U. S. P.*).

Chemical Composition.—The first article of interest regarding this plant, from a pharmaceutical point, appeared in the *Chicago Pharmacist*, February, 1876, from Mr. H. S. Wellcome. He gave a figure of the plant, and reported finding several resinous bodies. Mr. Charles Mohr (*Proc. Amer. Pharm. Assoc.*, 1879, and *Amer. Jour. Pharm.*, 1879, p. 545), upon distilling 10 pounds of the dried leaves with water, found the distillate free from volatile alkaloid, but it contained a small amount of an oily substance, of an aromatic odor and taste. The herb yielded to ether 8 per cent of a bitter, acrid resin, and to alcohol an inert resin; besides, Mr. Mohr found a peculiar, tannin-like glucosid, gum, green coloring matter, sugar, wax, etc. Rich. Thal, in 1883, announced the presence of *ericolin* ($C_{26}H_{30}O_3$), a glucosid, in this plant. Rother (1887) obtained an acid resin forming soluble compounds with bases; these compounds, by double decomposition, precipitate quinine from solutions of its salts in the form of salts of quinium-resin. The latter compounds are singularly soluble in ammonia (*Amer. Jour. Pharm.*, 1887, p. 225). In 1888, Quirini, by extracting the drug with carbon disulphide, obtained, beside a green resin, insoluble in benzol, *eriodictyonic acid* ($C_{14}H_{18}O_5$), in yellow, deliquescent plates, soluble in benzol, and melting at 86° to 88° C. (186.6 to 190.4° F.). They have a sweetish-acid taste, and are closely related to *phloroglucin.* Prof. J. U. Lloyd, who has prepared considerable amounts of the fluid extract of this plant (dried), strongly favors alcohol as the best agent for extracting and permanently holding the proximate resinous principles in solution.

Action, Medical Uses, and Dosage.—Eriodictyon (or Mountain balm) has been recommended in the treatment of *laryngeal* and *bronchial affections*, and in *chronic pulmonary difficulties* generally. It has also been eulogized in the treatment of *asthma* and *hay-fever*, in combination with Grindelia robusta. That it possesses some efficiency as a stimulant, in the treatment of *chronic mucous affections of the respiratory passages*, is undoubtedly true; but that it deserves the high encomiums passed upon it in the treatment of *laryngo-bronchial* and *chronic pulmonary maladies*, admits of great doubt; at least, the writer has met with no success with it in any of the above diseases that was superior, or even equal, to the results obtained by some of our old and well-known remedial agents. It has likewise been advised in the treatment of *hemorrhoids*, and in *chronic catarrh of the bladder*. *Catarrhal gastritis* is said to have been successfully treated with it. The article is generally employed in the form of fluid extract and specific yerba santa. The dose of the former varies from 15 minims to 1 fluid drachm; of the latter, 10 to 30 minims, taken in a little syrup, and repeating the dose every 3 or 4 hours.

Specific Indications and Uses.—"Chronic asthma with cough, profuse expectoration, thickening of the bronchial mucous membrane, loss of appetite, impaired digestion, emaciation" (Watkin's *Comp. of Ec. Med.*). "Cough, with abundant and easy expectoration" (Scudder).

ERYNGIUM.—WATER ERYNGO.

The rhizome of *Eryngium yuccæfolium*, Michaux (*Eryngium aquaticum*, Jussieu).

Nat. Ord.—Umbelliferæ.

COMMON NAMES: *Eryngo*, *Water eryngo*, *Buttonsnake root*, *Rattlesnake's master*, *Corn snakeroot*.

Botanical Source.—This plant is an indigenous perennial herb, with a single stem, from 1 to 5 feet in height. The root is tuberous. Its leaves are from 1 to 2 feet long, by ½ an inch to 1½ inches wide, broadly-linear, parallel veined, taper-pointed, grass-like, ciliate, and armed with remote soft spines. The bracts are tipped with spines, those of the involucels being entire and shorter than the heads. The flowers, which are white or pale and inconspicuous, are disposed in ovate-globose heads, which are pedunculate, and from ½ to 1 inch in diameter. The calyx is 5-parted and permanent; the styles slender; the petals connivent, oblong, and emarginate, with a long, inflexed point. The fruit is scaly, top-shaped, and bipartile (W.—G.).

History and Description.—This plant is a native of the United States, growing in swamps and low, wet lands, from Virginia to Texas, and especially on the prairie lands. It flowers in August. The root is the medicinal part. It has a dark-brown, very knotty rhizome, wrinkled horizontally, with many fibers of the same color, growing downward, furrowed or wrinkled longitudinally, and from a line to a line and a half in thickness. Internally it is yellowish-white, of a peculiar odor, somewhat resembling that of *Iris versicolor*, and a faintly-sweetish, mucilaginous, aromatic taste, succeeded by bitterness, some degree of pungency affecting the fauces, and a very slight astringency. It is easy to pulverize. Water or spirit extracts its properties. It has not been analyzed, but is worthy of attention.

Eryngo was one of the earliest known remedies, and was declared by Dioscorides to be a specific against flatulence, hence the name eryngium, derived from the Latin *erynge*—Greek *erugge* (to eruct, to belch). Its common names are *water eryngo*, *button snakeroot*, *corn snakeroot*, and *rattlesnake's master*. It was formerly lauded as an effective agent for the cure of rattlesnake-bites, hence the name *rattlesnake's master* and *button snakeroot* applied to it. It was likewise used for other bites and stings. A piece of the root was chewed and applied to the wound; at the same time a portion of the juice was swallowed. Much was claimed for it, but probably its virtues were very much overrated.

Action, Medical Uses, and Dosage.—Eryngium is diuretic, expectorant, diaphoretic, and sialogogue. Large doses will cause emesis. The root, when masticated, produces a copious flow of saliva. As an expectorant and diaphoretic, it is useful in *chronic laryngitis* and *bronchitis*, when there is free and abundant discharge of muco-pus. It has been recommended as a substitute for senega. It relieves *chronic pharyngitis*, when associated with laryngeal irritation. In *general debility* and *dyspepsia* it may be employed to improve the appetite and gastric functions. It is indicated here by persistent irritation with red and tender tongue, nausea, and easily provoked disgust for food. The *diarrhœa of dentition*, when most largely mucus, is controlled by eryngium. It has been a favorite drug in renal disorders, especially *gravel*, *chronic nephritis*, and *atonic dropsy*, when dependent on renal irritation. It lessens irritation of the reproductive organs of both the male and the female. By lessening the erectile power, it is valuable in those cases of *nocturnal emissions* accompanied by erection and urethral irritation, *pain in the testes*, and *irritation of the bladder*. It is frequently indicated in *gonorrhœa*, *gleet*, and *leucorrhœa*.

While a good remedy for the above-named purposes, it is as a remedy for *vesical* and *urethral irritation* that the drug is entitled to its high rank among specific medicines. It may be employed in acute or chronic inflammatory or irritative conditions, when accompanied by burning and itching in the bladder or the prostatic and spongy portions of the urethra. Uneasy sensations throughout the vesical, prostatic, and urethral portions of the urinary tract, which might lead to serious consequences, are relieved by it. Dull, aching, tenesmic pain is relieved by it combined with gelsemium. In *acute cystitis* it should be used with the indicated sedative. *Reproductive disorders of women*, with vesical complications, are readily controlled by it, being of special value where there is a burning, tenesmic pain—a condition frequently encountered in gynecological practice. It is particularly valuable in *dysuria* from irritation, and in cases marked by determination of blood to the bladder. It relieves the *painful urination* incident to *gonorrhœa*. Like gelsemium, it is a first-class remedy for *spasmodic urethral stricture*. In *chronic cystitis* it is valuable when the secretions are scanty and when triple phosphates are present. It is a good remedy for *vesical catarrh*. It is always indicated in renal diseases with deep-seated burning, or burning pain. *Urethral inflammation*, with difficult micturition and irritable urethra in the aged, are conditions to which it is particularly adapted. It is said to relieve *renal colic*, dependent on the passage of *renal calculi*. Its power here is not important, except when combined with other indicated remedies.

As with a large number of remedies, it has not escaped mention as a remedy for *syphilis* and *scrofula*. The pulverized root, in doses of 2 or 3 grains, has proved very effectual in *hemorrhoids* and *prolapsus ani*. Two ounces of the pulverized root, added to 1 pint of good Holland gin, has effected cures in obstinate cases of *gonorrhœa* and *gleet;* to be administered in doses of 1 or 2 fluid drachms 3 or 4 times a day. By some practitioners this root is employed as a specific in *gonorrhœa*, *gleet*, *mucus diarrhœa*, and *leucorrhœa;* used internally in syrup, decoction, or tincture, and the decoction applied locally by injection. Dose of the powder, from 20 to 40 grains; of the decoction, which was formerly principally used, from 2 to 4 fluid ounces, several times daily. The best preparation is specific eryngium, the dose of which may range from 1 to 20 drops, administered in water.

Specific Indications and Uses.—The indications for eryngium are burning pain, with vesical, renal, or urethral irritability; uterine irritation, with bladder disorders; painful micturition; frequent desire to urinate; frequent, scanty, and scalding urination; cystic uneasiness; pain in the bladder extending to the loins; scanty urine, with frequent and ineffective attempts to empty the bladder; vesical catarrh; mucous diarrhœa; dyspepsia, with persistent gastric irritation.

ERYTHRONIUM.—ADDER'S TONGUE.

The leaves and root of *Erythronium americanum*, Smith (*Erythronium lanceolatum*, Pursh).

Nat. Ord.—Liliaceæ.

COMMON NAMES: *Adder's tongue*, *Dog's-tooth violet*. *Yellow snowdrop*, *Rattlesnake violet*, *Yellow erythronium*.

Botanical Source.—Adder's tongue is an indigenous, perennial herb, with a cormus or bulb at some distance below the surface, which is white internally, and fawn-colored externally. The scape is naked, slender, and 3 or 4 inches high. The leaves are 2, subradical, lanceolate, and involute at the point, pale-green, with purplish or brownish spots, about 5 inches long, and one of them nearly twice as wide as the other. The flower is single, drooping, yellow, liliaceous, spotted near the base, expanded and revolute in the sunshine, and closing somewhat at night and on cloudy days. The segments of the perianth are oblong-lanceolate, obtuse, the inner ones being bidentate near the base. Stamens 6, filaments flat, anthers oblong-linear. Ovary obovate; style club-shaped, longer than the stamens, 3-lobed at top, terminating in 3 undivided stigmas. The capsule is oblong-obovate, stipitate, and 3-valved; the seeds rather numerous and ovoid, with a loose membranous tip (W.—G.).

History.—This is a beautiful little plant, among the earliest of our vernal flowers, found in rich, open grounds, or in thin woods throughout the United States; it flowers in April or May. The bulb and leaves are the parts used, and impart their virtues to water. The leaves are said to be more active than the root, and the dried drug much less active than when freshly gathered.

Action, Medical Uses, and Dosage.—Emetic, emollient, and antiscrofulous when fresh; nutritive when dried. The fresh roots and leaves, simmered in milk, or the fresh leaves, bruised and applied as a poultice to *scrofulous ulcers* or *tumors*, together with a free internal use of an infusion of them, is highly recommended as a remedy for *scrofula*. The expressed juice of the plant, infused in cider, is reputed useful in *dropsy*, and for relieving *hiccough*, *vomiting*, and *hematemesis*. Twenty-five grains of the fresh root, or 40 of the recently dried root, will operate as an emetic, though this result is sometimes uncertain.

ERYTHROPHLEUM.—SASSY BARK.

The bark of *Erythrophleum guineense*, Don (*Erythrophleum judiciale*, Procter; *Fillæa suaveolens*, Guillemin and Perrottet).

Nat. Ord.—Leguminosæ.

Common Names: *Sassy bark*, *Mancona bark*, *Teli*, *Bondou*, *Bourane des floupes*.

Illustration: *American Journal of Pharmacy*, Vol. XXIII.

Botanical Source and History.—Sassy bark is obtained from a large forest tree of Western Africa, and was first brought into notice by Prof. Procter (1851), who referred it to the genus *Erythrophleum* (Afzelius), and named it E. *judiciale*. Upon subsequent examination, Lindley identified it as the *E. guineense*, G. Don (*Fillæa suaveolens*, Guillemin and Perrottet). The tree has a close resemblance, both in leaves and fruit, to the *Gymnocladus canadensis*, or *Coffee-nut tree* of the United States. The leaves are bipinnately compound, and have ovate, acute leaflets, which are smooth, coriaceous, and alternate. The flowers are in dense, terminal, compound racemes; they are regular, and have a 5-cleft calyx, and 5 petals, imbricated in the bud; the 10 stamens are distinct and perfect. The fruit is a thick, leathery, brown legume, containing from 3 to 5 oblong, flat, albuminous seeds. The tree, when wounded, yields a red juice (whence the generic name), which, like the bark, is used by the natives as an ordeal, and as a poison for their arrows.

Description.—The bark occurs in flattened, or more or less curved pieces, of various sizes, of a reddish-brown color, somewhat similar to the color of ferric hydrate, and usually having an external, corky covering, irregularly fissured; it is hard, friable, odorless, and astringent to the taste.

Chemical Composition.—Prof. Procter, Jr. (1851), examined the bark, but failed to isolate the poisonous principle; he predicted its separation, and remarked that when found, it would "possess great activity," a prediction since verified by N. Gallois and E. Hardy, who, in 1876, succeeded in obtaining the alkaloid *erythrophleine*, and demonstrating, by experiment, its fatal action upon animal life. *Erythrophleine* is an organic base, and may be obtained by extracting the bark with alcohol slightly acidulated with hydrochloric acid, evaporating the tincture to a small bulk, exhausting this, when cold, with warm distilled water, evaporating the resulting solution, adding ammonia (or sodium carbonate) to the residue until it has an alkaline reaction, and then agitating the mixture with acetic ether, from which the alkaloid may be obtained by evaporation. Erythrophleine is crystalline, transparent, colorless, and soluble in water, acetic ether, alcohol, and amylic alcohol; only slightly soluble in ether, benzin, and chloroform. It forms salts with acids; is very poisonous, acting upon and paralyzing the heart. Curare, it is said, delays its effects. Boiled in the presence of diluted acids or alkalies erythrophleine yields *mançonine*, a volatile, alkaloidal base, bearing some resemblance to nicotine, and a non-nitrogenous *erythrophleic acid*. Procter found both tannic and gallic acids, gum, resin, and other minor constituents.

Action, Medical Uses, and Dosage.—Sassy bark furnishes a red decoction, which is used by the natives on the western coast of Africa as an emeto-cathartic, and as a test for the detection of criminals; should it purge the person is considered guilty, but if it causes vomiting only, he is deemed innocent. The action of the bark has been investigated by Dr. T. Lauder Brunton and Walter Pye, Esq., in *Philosophical Transactions of the Royal Society*, Vol. 167, Part II, and by Santos, Liebreich, and others. Used hypodermatically, it is stated to produce vomiting, but no catharsis. In large doses it occasions a progressive stupefaction, when administered to animals, with complete muscular relaxation, paralysis of the heart's action, and death. During the progress of these effects there may also be observed a period of restlessness, succeeded by vomiting, quickened and labored respiration, and finally convulsions. With man it is said to produce vomiting, vertigo, muscular relaxation, gradual cessation of the heart's movements, with dyspnœa, convulsions, and death. The cause of its effects appear, according to investigators, to be owing to the fact that it contracts the blood vessels, thus occasioning an increased blood pressure, resulting in the symptoms named. The alkaloid, erythrophleine, was at one time recommended as a substitute for cocaine in eye surgery. Its effects on the conjunctiva and cornea are so severe, however, that this idea has been abandoned, as the untoward symptoms do not subside for several days. Besides it is charged with being painful, as well as provocative of inflammation, cloudiness, and exfoliation of the corneal structures. Therapeutically, it has been found efficient in those affections in which an agent was indicated, combining narcotic, astringent, and cholagogue properties, as in *diarrhœa*, *dysentery*, *passive hemorrhages*, etc. It has likewise been suggested in *dropsy*, due to obstruction of the mitral valves, and in *capillary hemorrhages*. Prof. Scudder states that it may be "given to stimulate the capillary circulation, to increase secretion of urine, arrested by feeble circulation, and to check *atonic diarrhœa*." For this purpose he suggests the minute dose, a teaspoonful of a solution of 1 drop of the tincture in 4 ounces of water. A tincture of the bark is probably the best form for administration in doses of from a fraction of a drop to 5 drops. Brunton and Pye consider the watery extract more powerful than the alcoholic. The powdered root is a violent sternutatory.

ESSENTIÆ.—ESSENCES.

Essences are alcoholic solutions of volatile oils differing from the official class of preparations known as *Spiritus* or *Spirits*, in strength only. Essences, as a rule, are about three times stronger than the spirits. The *British Pharmacopœia* recognizes two essences, *Essence of anise* and *Essence of peppermint*.

Essentia Anisi, *Essence of anise*.—Mix 1 fluid ounce of oil of anise with 4 fluid ounces of rectified spirit. This is in accordance with the *British Pharmacopœia*. Properties same as oil of anise, which see. Dose, from 10 to 20 drops.

Essentia Menthæ Piperitæ, *Essence of peppermint*.—Mix 1 fluid ounce of oil of peppermint with 4 fluid ounces of rectified spirit. This accords with the formula of the *British Pharmacopœia*. Properties those of oil of peppermint, which see. Dose, 10 to 20 drops.

EUCALYPTOL (U. S. P.)—EUCALYPTOL.

Formula: $C_{10}H_{18}O$. Molecular Weight: 153.66.

"A neutral body obtained from the volatile oil of *Eucalyptus globulus*, Labillardière, and of some other species of *Eucalyptus* (*Nat. Ord.*—Myrtaceæ). Eucalyptol should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

Synonyms: *Cineol*, *Cajuputol*.

Preparation and History.—In preparing the oil of eucalyptus from eucalyptus leaves, that portion distilling between 170° C. (338° F.) and 178° C. (352.4° F.), is called *crude eucalyptol.* It may be purified by surrounding the crude eucalyptol by a refrigerating mixture, when eucalyptol separates in long, needle-like, colorless crystals. The crystals are then drained from their adherent oil, and the process of crystallizing is repeated several times. Eucalyptol may be obtained from other oils as well as from those of the various species of Eucalyptus (see *Amer. Jour. Pharm.*, 1889, p. 371). Thus it forms a constituent part of oils of cajuput and of rosemary, and is particularly abundant in the *Oil of Santonica*, from *Artemisia pauciflora*, Weber, which, in fact, is almost wholly composed of eucalyptol. Wallach and Brass, in 1884, prepared it from the latter oil by forming a crystalline compound with gaseous hydrochloric acid, pressing off the mother-liquor, liberating the eucalyptol with water, purifying with caustic potash in warm alcoholic solution, and finally drying and rectifying the oil. According to Schimmel's *Report* (April, 1891), eucalyptus oil from *E. oleosa* is also rich in eucalyptol, solidifying when put into a freezing mixture. Jahns, in 1885, found eucalyptol to possess the formula $C_{10}H_{18}O$, and to be identical with *cineol*, a substance obtained by Wallach and Brass, in 1884, from oleum cynæ, and found in turn to be identical with *cajuputol*, from oil of cajuput.

In 1895, Mr. Scammell, in Adelaide (Australia), took out a patent for the preparation of eucalyptol from oil of eucalyptus, the process consisting in the formation of a crystalline compound of phosphoric acid with eucalyptol, decomposable afterward by water into its constituents (*Pharm. Centralh.*, 1895, p. 419). A crystallizable acid may be produced by acting upon eucalyptol with nitric acid, while phosphoric anhydride (P_2O_5) converts it into *eucalyptene* ($C_{10}H_{16}$), and *eucalyptolen.*

Description and Tests.—"A colorless liquid, having a characteristic, aromatic, and distinctly camphoraceous odor, and a pungent, spicy, and cooling taste. Specific gravity, 0.930 at 15° C. (59° F.). Boiling point, 176° to 177° C. (348.8° to 350.6° F.). It is optically inactive (distinction from the oil of eucalyptus and many other volatile oils). When exposed to a temperature some degrees below 0° C. (32° F.), or placed in a freezing mixture, it solidifies to a mass of colorless, needle-shaped crystals, which liquefy at —1° C. (30.2° F.). Soluble, in all proportions, in alcohol, carbon disulphide, and glacial acetic acid. If a portion of eucalyptol be shaken with an equal volume of sodium hydrate T.S., it should not diminish in volume. Its alcoholic solution should be neutral to litmus paper, and should not assume a brownish or violet color on the addition of a drop of ferric chloride T.S. (absence of phenols)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(Same as *Eucalyptus*, which see).

EUCALYPTUS (U. S. P.).—EUCALYPTUS.

"The leaves of *Eucalyptus globulus*, Labillardière;" "collected from the older parts of the tree"—(*U. S. P.*).

Nat. Ord.—Myrtaceæ.

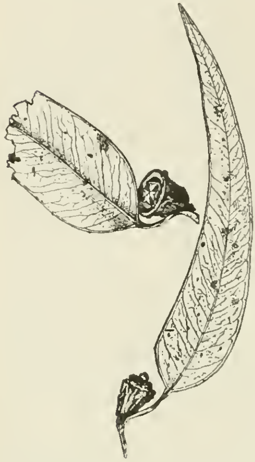
COMMON NAME: *Blue-gum tree.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, Plate 109.

Botanical Source and History.—The genus, Eucalyptus, is noted as being an extensive and almost exclusively Australian family of trees; for, although 134 species are recorded by Bentham (*Flora Australiensis*), as natives of that continent, only 2 or 3 species are found to grow in any other lands. The Eucalyptus trees are very numerous in their native country, and constitute an important feature in every landscape. They are sometimes shrubs, but generally trees, which often attain gigantic size. Most of the species secrete a resinous substance, and hence are known to the Australian colonists as "gum trees." The leaves, which are always entire, are very variable in shape and position. In the young trees they are always opposite and horizontal, but, in older trees, they generally become alternate, and, by a peculiar twist of the leaf-stalks, present the edges instead of the flat surfaces to the ground, thus giving the Eucalyptus a strange appearance, different from that of any of our American trees. The flowers of the Eucalyptus trees are generally in umbellate clusters. The calyx is partially adnate to the ovary, and furnished in the bud with a conical lid or cap, covering the stamens, but which, when the flower expands, separates from the lower part of the calyx by a circular dehiscence, and falls off entire. There are no petals, but the stamens are numerous, and are sometimes united into 4 sets. The fruit, which is dry and enclosed in the hardened calyx, contains 3 or 4 cells, and usually ripens but 2 or 3 seeds to each cell.

The botanical history of the genus, *Eucalyptus*, is not yet thoroughly established. The leaves of the same species, at different stages of their growth, are extremely variable, and the species are so numerous and so closely allied, that positive specific differences are very difficult to find. The colonists classify them by the bark, which is either smooth, rough, or sometimes scaly.

Fig. 108.



Leaves and fruit of Eucalyptus globulus.

Eucalyptus globulus.—This is one of the most valuable of Australian trees, on account of the timber, which is strong and durable. It is a large tree, often exceeding 200 feet in height, and known to colonists as "blue-gum," although the name is applied to at least 6 other species. The *Eucalyptus globulus* is placed, by Bentham (*Flora Australiensis*), in the series Normales, which have "perfect stamens with globular anther cells, opening longitudinally." The flowers are large, sessile, and produced in axillary clusters of 1 to 3. The mature leaves are from 6 to 12 inches long, and borne on wrinkled, twisted stalks, about 1 inch in length. They are narrowly lanceolate and falcate, with entire and thickened edges; they are obtuse or cordate at the base, and gradually tapering at the apex to an acuminate point. Their texture is very firm, so that the leaves retain their shape without wrinkles when dried. The veins are confluent near the margin. The entire leaf is thickly sprinkled with pellucid oil dots, and the surface, when dry, with minute black specks.

The leaves of *Eucalyptus globulus* constitute, in Australia and adjacent countries, the popular remedy against fevers, and especially in obstinate palustrial fevers. They are firm, coriaceous, and, in the green state, resist the attacks of grasshoppers and locusts. They have a strong, agreeable, aromatic odor, and a warm, bitterish, and aromatic taste, which, as with peppermint leaves, is followed by a cool sensation in the mouth.

Description.—The mature leaves, which are gathered from the older parts of the tree, are thus described by the *U. S. P.:* "Petiolate, lanceolately scythe-shaped, from 15 to 30 Cm. (6 to 12 inches) long, rounded below, tapering above, entire, leathery, grayish-green, glandular, feather-veined between the mid-rib and marginal veins; odor strongly camphoraceous; taste pungently aromatic and somewhat cooling, bitter and astringent"—(*U. S. P.*).

Chemical Composition.—The leaves have been analyzed by Cloez, Faust and Homeyer, M. F. A. de Hartzen, and Prof. E. S. Wayne. According to Cloez, they contain tannin in quite a large proportion, resinous matter, and an essential oil (see *Oleum Eucalypti*), which has been found to consist chiefly of *eucalyptol* (*cineol*, $C_{10}H_{18}O$) (see *Eucalyptol*). Rabuteau failed to discover a basic principle after having freed an alcoholic extract of the leaves from oil, tannin, and resin. H. Weber found a white crystalline body, mixed with an amorphous resinous mass, both of acid reaction; an acid yellow resin, of bitter taste; an acid named *eucalyptic acid;* and a neutral, crystallizable, bitter substance, soluble in ether and alcohol, and only slightly soluble in water. Prof. E. S. Wayne obtained a crystallizable acid resin, capable of producing, with ferric chloride, a brown-red reaction.

Action, Medical Uses, and Dosage.—The oil of eucalyptus (which is chiefly eucalyptol) and eucalyptol, in small doses, are gentle stimulants; in large doses, they occasion irritation of the throat and fauces, with increased flow of saliva; cephalagia, with extreme fatigue; frequency of the pulse; increased temperature;

diminution of vascular tension; gastric irritability, and, not unfrequently, diarrhœa, accelerated respiration, the peculiar odor of the oil being exhaled with the breath; and increase of the urinary excretion. In some instances a sort of intoxication results from large doses (20 drops) of eucalyptol, and large doses of it and of eucalyptus produce some drowsiness and lack of power over the limbs. The chief eliminatory organs appear to be the lungs and kidneys, the drug causing an increased elimination of urea. Locally, the oil is irritant, particularly if not allowed to evaporate.

Eucalyptus globulus has for a long time been known as a remedy for *intermittent fever* among the natives of the countries of its origin. It is stated that more than 40 years ago the corvette, "*La Favorite*," being in the vicinity of Botany Bay, had her crew nearly decimated by a *pernicious fever*, and that a perfect recovery ensued among those remaining upon using an infusion of the leaves of Eucalyptus; the credit of this discovery is given to Dr. Eydoux and M. de Salvy. Dr. Ramel, of Valencia, is said to have introduced the remedy into Europe, in a statement made to the Academy of Medicine, in 1866; since which period its therapeutical virtues have been examined by many investigators. The emanations from this tree have, it has been reported, a strong antagonistic influence against those conditions termed malarial, and, on this account, it has been cultivated in various places in Europe where these conditions appear to have had a permanent existence.

Notwithstanding the high encomiums passed upon this agent as an antipyretic by the majority of those who have tested it, there are certain other investigators who are less enthusiastic; thus, Dr. Burdell, who tested it in the miasmatic fevers encountered in the marshy district of Sologne, France, states that, though eucalyptus has been sometimes found a febrifuge nearly equal to quinine, at other times it has proven to be discouragingly inefficient. (Indeed, the same may be observed of quinine and all other remedies, unless specifically indicated.) After thoroughly testing it in 123 cases, he concluded that it possessed but little or no antimalarial power. He states that the cures effected by it have been more frequent in the hospital than in the palustral localities, and which may be readily accounted for. Very often, as Chomel has shown, persons attacked with intermittent fever are cured in the hospital without any medicines having been employed. Dr. Carlotti, of Ajaccio, considers a quickly made decoction of the leaves to be of great value in those cases of intermittent fever that do not yield to quinine. He gives the decoction in doses of from 2 to 5 fluid drachms. Prof. Locke states that it is not so useful in *recent ague* as cinchona bark, but better in *chronic ague*, "in cases attended with excessive discharges or drain upon the system, as *diarrhœa*, *dysentery*, etc." He recommends 10-drop doses of specific eucalyptus in *chronic obstinate diarrhœa*, when no ague is present

Aside from its alleged utility in intermittents, this agent has had other virtues attributed to it, as follows: The leaves and their preparations have been successfully used as a tonic and gently stimulating stomachic, in *atonic dyspepsia*, and in *catarrh of the stomach* and *typhoid fever;* also advised in *mucous catarrhal affections* generally; in *pseudo-membranous laryngitis*, in *asthma*, with profuse secretion, and in *chronic bronchitis*, with or without *emphysema*, and in *whooping-cough;* it has likewise proved efficient in *chronic catarrh of the bladder*, where the urine is high-colored, contains an abnormal amount of mucus, or, perhaps, some purulent matter, and micturition is attended with much pain. More recently it has been recommended as a diuretic in the treatment of *dropsy*. Both the leaves and the oil, as well as eucalyptol, are excitants and deodorizers, and, as such, have been successfully employed as local applications in *bronchial affections* with fetid expectoration, in *ozena*, in fetid or profuse mucous discharges, in *vaginal leucorrhœa*, offensive lochial discharges, *gonorrhœal discharges*, *indolent*, *fetid wounds* or *ulcers*, *cancerous ulcerations*, in *septicemia*, and in *gangrene*. An excellent application in *leucorrhœa*, with relaxation of the vaginal walls, is prepared as follows: R Sea salt, 1 lb.; fluid extract of eucalyptus, fl℥ss. Place the salt in an earthenware or tin vessel, and pour upon it the extract and mix thoroughly. A half ounce of this preparation may be added to 1 pint of hot water and injected by means of a glass or metallic syringe. M. Bucquoy has found eucalyptus to exert a happy influence in the treatment of *pulmonary gangrene*. M. Luton, and others, have derived considerable benefit from it, when locally applied in *cancerous affections*, in the form of a compress of lint moistened with the tincture. It has likewise been advised to prevent putrefaction of organic substances, and to deodorize sick-rooms and apartments containing unhealthy air. The leaves may, in some cases, be applied alone, directly to the part, in form of cataplasm; or they may be combined with other articles to form a poultice. The oil may be applied of full strength, or diluted with some other agent. In throat and pulmonary maladies, a tincture diluted, or a medicated water, may be inhaled in the form of spray; if the oil be employed, it may be dropped on some cotton placed in a small tube, from which the vapor may be inhaled. As a deodorizer, the tincture or the oil may be sprinkled or sprayed upon the offensive body, or the atmosphere of an apartment may be frequently sprayed with the same. Eucalyptol acts very much like the oil and both somewhat resemble turpentine in their effects. Like eucalyptus, it is used in *foul and purulent respiratory diseases*, particularly *fetid bronchorrhœa*, *chronic bronchitis*, *pulmonary gangrene*, and *pulmonary tuberculosis*, etc.

The dose of eucalyptol and of the oil is from 2 to 10 drops, and it is more convenient to administer it in capsules. One part of either combined with 100 parts of cod-liver oil has proved serviceable in *phthisis;* it removes the offensive taste and odor of the fish oil. Eucalyptol is now given in many instances where the oil was formerly administered on account of the greater definiteness of the dose, as the oil depends for its virtues upon the percentage of eucalyptol present. Both have been given for the relief of *migraine*, and, externally applied, give relief in some forms of *neuralgic* and *rheumatic pains.*

The leaves of eucalyptus, made up into cigars or cigarettes, and smoked, have been advised to afford relief in *bronchial catarrh*, *asthma*, and other affections of the respiratory organs. The question has been asked, may not the small amount of benefit that might be derived from the minute proportion of oil remaining intact, be more than overcome, and even prove injurious, from the irritating action of the smoke and of the empyreumatic products?

The most agreeable and convenient forms of administration are the tincture, in doses of 10 to 30 drops; or the fluid extract in doses of 5 to 30 drops, in syrup; or, preferable to all, specific eucalyptus, from 10 to 30-drop doses in malarial troubles, and from 5 to 10-drop doses in other troubles. It may be given with glycerin or syrup, as it does not mix well with water. The dose of the oil and of eucalyptol is from 5 to 10 minims, preferably in capsules.

EUCALYPTUS HONEY, gathered by bees from eucalyptus flowers, is quite active, and has been recommended for *parasitic* and *putrescent conditions*, *gonorrhœa*, *fevers*. and *catarrhal diseases*. It is sedative to the heart, actively diuretic, and increases the elimination of uric acid.

Specific Indications and Uses.—Sensations of coldness and weight in the bowels; cold extremities; cold perspiration; perspiration during chill; chronic catarrhal diarrhœa; chronic vesical catarrh, the urine containing pus; unhealthy fetid secretions from any part; relaxed mucous tissues, with profuse secretion; pasty, badly-smelling coating upon the tongue; fetid false membranes; sore throat, with fetid odor; fetid and catarrhal states of the broncho-pulmonic tract; and, in large doses, in chronic ague with exhausting discharges.

Related Drugs.—EUCALYPTI GUMMI. This new addition to the *British Pharmacopœia* is furnished by the bark of *Eucalyptus rostrata*, Schlechtendal, as well as other species of eucalyptus. It is an exudation from the bark and has a ruby-red color, and is the so-called *red gum* from these trees. It resembles kino, though less astringent and possessing a brighter appearance. It has a bitter taste. When pure, it is almost entirely dissolved by alcohol, and, added to water, forms a solution containing from 80 to 90 per cent of the drug, having a neutral reaction (see *Botany Bay Kino*). Dose, 2 to 10 grains. For an account of the properties of this gum, see P. L. Simmonds, *Amer. Jour. Pharm.*, 1895, p. 132.

Anacharis Alsinastrum.—This plant is a native of Canada, and is credited with anti-malarial properties. When introduced into districts where *malaria* and *malarial diarrhœa* are prevalent, it is said to diminish the number of cases of these disorders (*Medical Bulletin*).

EUONYMUS (U. S. P.)—EUONYMUS.

"The bark of the root of *Euonymus atropurpureus*, Jacquin"—(*U. S. P.*).

Nat. Ord.—Celastrineæ.

COMMON NAMES: *Wahoo*, *Indian arrow-wood*, *Burning bush*, *Spindle tree.*

Botanical Source.—This is a small shrub or bush, with smooth branches, and rising from 5 to 10 feet in height. Its leaves are from 2 to 5 inches in length, about half as wide, opposite, on petioles ⅓ to 1 inch in length, elliptic-lanceolate, mostly acute at base, finely serrate, and pubescent beneath; the peduncles are opposite, slender, compressed, from 1 to 2½ inches in length, each with a cyme of from 3 to 6 flowers. The flowers are dark-purple, and usually pentamerous; the corolla about 2½ lines in diameter, flat, inserted on the outer margin of a glandular disc; the calyx flat, of 4, 5, or 6 united sepals; the stamens 5, with short filaments; the capsule or pod smooth, crimson, 5-angled, 5-celled, and 5-valved; the seeds, 1 or 2 in each cell, are inclosed in a red aril (W.—G.).

History.—There are two species of Euonymus used in medicine—the spindle-tree, *E. atropurpureus*, and the burning bush, or *E. americanus*, to both of which the term *Wahoo* is indiscriminately applied. They grow in many sections of the United States, in woods and thickets, and in river bottoms, and flower in June. The bark of the root is the medicinal part. It has a bitter, and somewhat unpleasant taste. Water or alcohol extracts its virtues.

Description.—The *U. S. P.* thus describes this drug: "In quilled or curved pieces, from 2 to 5 Mm. ($\frac{1}{12}$ to ⅕ inch) thick; outer surface ash-gray, with blackish patches detached in thin and small scales; inner surface whitish or slightly tawny, smooth; fracture smooth, whitish, the inner layers of a laminated appearance; nearly inodorous; taste sweetish, somewhat bitter and acrid"—(*U. S. P.*).

Chemical Composition.—Charles A. Santos found in the aqueous distillate of the bark of Euonymus atropurpureus, a volatile oil (*Amer. Jour. Pharm.*, 1848, p. 83). Clothier, in 1861, detected starch, glucose, and pectin matter. In the following year Mr. Wm. T. Wenzell (*Amer. Jour. Pharm.*, 1862, p. 385), found a non-crystallizable, bitter principle, *euonymin* (not to be confused with the old Eclectic concentration of that name), *asparagin*, crystallizable and non-crystallizable resins, fixed oil, malic, citric, and tartaric acids, the peculiar *euonic acid*, and inorganic salts. The name euonymin was first affixed to the dried powdered solid extract about 50 years ago, and was included among the Eclectic resinoids or concentrations. This is the only preparation used in medicine under the name euonymin, and must not be confused with the definite, proximate principle that follows, and which is only of chemical interest. *Euonymin*, as obtained from E. atropurpureus by Prof. Meyer and Dr. Romin, of Dorpat, by an elaborate process (*Pharm. Centralh.*, 1885, p. 220), is a crystalline glucosid which corresponds in its physiological action closely with digitalin. It is sparingly soluble in water and ether, and easily soluble in alcohol. In 1884, H. Paschkis (*Pharm. Centralh.*, p. 196), called attention to the occurrence of *mannit* as a seemingly regular constituent of all species of Euonymus. Naylor and Chaplin (*Chemist and Druggist*, 1889, p. 822), identified a certain sweet substance which they had obtained from *Euonymus atropurpureus* and provisionally named *atropurpurine* a few months before, as *dulcit* ($C_6H_{14}O_6$), which is an isomer of mannit.

Action, Medical Uses, and Dosage.—Euonymus has been in use among physicians for a long time. The bark is tonic, laxative, alterative, diuretic, and expectorant; the seeds are cathartic and emetic. In infusion, syrup, or extract, it has been successfully used in *intermittents*, *dyspepsia*, *torpid liver*, *constipation*, *dropsy*, and *pulmonary affections*. Prof. Locke states "there are but few good stomach tonics, and this agent is one of them." It stimulates the biliary flow, and has considerable anti-malarial influence, and may be used in intermittents after the chill has been broken with quinine. It stimulates the nutritive processes and improves the appetite. It may be used with advantage in *atonic dyspepsia*, and in *indigestion* due to hepatic topor or following malarial fevers. It is a remedy for *chronic ague*, and the consequent *obstinate constipation* and *gastric debility* accompanying or following it. A gin tincture (root ℥j to gin fl℥viij), is not without value in some cases of *dropsy*, particularly when associated with hepatic and renal inactivity. Dose of the tincture (℥viij to alcohol 76 per cent Oj), from 1 to 4 fluid drachms; of the syrup, from 1 to 2 fluid ounces; of the hydro-alcoholic extract from 5 to 15 grains; of the powder, from 20 to 30 grains; of specific euonymus, 1 to 30 drops.

Specific Indications and Uses.—Prostration with irritation of the nerve centers; periodical diseases, to supplement the action of quinine; anorexia, indigestion, and constipation, due to hepatic torpor.

Related Species.—*Euonymus americanus*, Linné, or *Strawberry-bush*, is of a smaller size than the preceding variety, with smooth, 4-angled branches; leaves oval and elliptic-lanceolate, sessile, subentire at the margin, acute or obtuse at apex, smooth, coriaceous, from ⅓ to 2 inches in length, about one-third as wide. Peduncles round, longer than the leaves, with 2, 3, or 4 flowers. Flowers somewhat larger than those of the preceding variety, yellow and pink; capsule dark-red, rough-warty, depressed, not so copious as in the former plant (W.—G.). Uses similar to those of the preceding species.

Euonymus europæus, Linné; Europe.—Cultivated somewhat in gardens. This species has lance-oblong leaves, smooth, shining, and serrate, and bears a flattened, 3-flowered pedicel, and greenish-white, 4-parted flowers. The capsule is light-red, and the arillus of an orange-red color. It is not hardy in northern latitudes. In 1833, Riederer isolated in an impure state a body which he thought to be an alkaloid, and gave to it the name *euonymine*, and this body he believed to impart the bitter taste to the bark. According to Grundner (1847), this is simply a mixture of bitter extractive and resin. Kubel extracted a body bearing resemblance to mannit, to which he gave the name *euonymit*. It is a crystallizable, saccharine principle differing from mannit in the fusing point and in crystalline structure (*Jour. de Pharm.*, 1862). All species of Euonymus possess an orange coloring matter, and a bitter oil having this characteristic color may be obtained from the arillus of the European species by means of pressure. The fruit of this, as well as of the foregoing species has been used in ointment form for the destruction of *lice*. All parts of the plant are nauseous, emetic, and purgative, while the leaves are said to poison sheep and cattle.

EUPATORIUM (U. S. P.)—EUPATORIUM.

"The leaves and flowering tops of *Eupatorium perfoliatum*, Linné"—(*U. S. P.*) (*Eupatorium connatum*, Michaux).

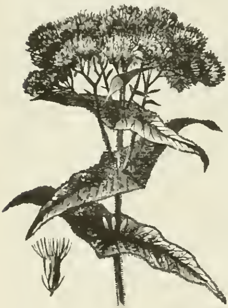
Nat. Ord.—Compositæ.

Common Names: *Thoroughwort, Boneset, Indian sage.*

Illustration: Bentley and Trimen, *Med. Plants*, 147.

Botanical Source.—Boneset, or Thoroughwort, as it is also called, is an indigenous perennial herb, with a horizontal, crooked root. The stems are round, stout, rough, hairy, and from 1 to 5 feet high. The leaves are opposite, connate-perfoliate, each pair resembling a single leaf centrally perforated by the stem, and placed at right angles to it; they are rough, rugose, serrate, tapering to a long point, very veiny, downy beneath, and both combined are from 8 to 14 inches in length. The flowers, which are numerous and white, are arranged in dense, fastigiate, terminal corymbs; the heads are about 12-flowered; the scales of the cylindrical, imbricated involucre linear-lanceolate; the florets tubular, with 5-spreading segments, and a rough, down-like pappus, and the anthers blue or black, and included. The style is filiform, and divided into 2 filiform, acuminate branches, which project beyond the corolla. The fruit or seeds are oblong, black, prismatic, acute at base, and supported on a naked receptacle (W.—G.—L.).

Fig. 109.



Eupatorium perfoliatum.

History and Description.—This is a well-known plant, growing in low grounds and on the borders of swamps, streams, etc., throughout the United States, flowering in August and September. The tops and leaves are the parts used. Alcohol or boiling water extracts its medicinal properties. Boneset is officially described as follows: "Leaves opposite, united at the base, lanceolate, from 10 to 15 Cm. (4 to 6 inches) long, tapering, crenately serrate, rugosely veined, rough above, downy and resinous-dotted beneath; flower-heads corymbed, numerous, with an oblong involucre of lance-linear scales, and with from 10 to 15 white florets, having a bristly pappus in a single row; odor weak and aromatic, taste astringent and bitter"—(*U. S. P.*).

Chemical Composition.—Mr. W. Peterson (*Amer. Jour. Pharm.*, 1851, p. 209), isolated from the aqueous extract of the leaves of Eupatorium perfoliatum by successive treatment with alcohol, subacetate of lead and ether, a micro-crystalline (feathery), very bitter substance, soluble in ether, but slightly soluble in water. Chlorophyll, gum, tannic acid, yellow coloring matter, salts, and lignin were also observed by him. Mr. Parsons (*Amer. Jour. Pharm.*, 1879, p. 343), found over 18 per cent of bitter extractive "soluble in water and alcohol, insoluble in ether." In the following year, Mr. George Latin (*Amer. Jour. Pharm.*, 1880, p. 392), found in the alcoholic extract made of the leaves and the tops of the plant, a crystallizable body, probably wax or resin, and *eupatorin*, the bitter principle which he proved to be a glucosid, soluble in alcohol, chloroform, ether, and boiling water. It develops a raspberry-like odor when heated with diluted sulphuric acid (Latin), or with diluted hydrochloric acid (Franz). A volatile oil was also observed. A complete analysis of the leaves alone is recorded by F. W. Franz (*Amer. Jour. Pharm.*, 1888, p. 77), while the root has been analyzed by H. F. Kaercher, who found nearly 5 per cent of *inulin* to be present (*Amer. Jour. Pharm.*, 1892, p. 511). C. H. Shamel obtained eupatorin both in amorphous and crystalline states by extracting an alcoholic extract with acidulated water, and abstracting the bitter principle with ether after neutralization with sodium carbonate. This substance, which is free from nitrogen, forms a well-crystallizable nitrate of the formula $C_{20}H_{2}H_{6}.HNO$, (*Amer. Jour. Pharm.*, from *Amer. Chem. Jour.*, 1892, p. 224).

Action, Medical Uses, and Dosage.—This is a very valuable medicinal agent. The cold infusion, or extract is tonic and aperient; the warm infusion diaphoretic and emetic. As a tonic, it is useful in *remittent*, *intermittent*, and *typhoid fevers*, *dyspepsia*, and *general debility;* and combined with bitartrate of potassium and camphor, the powdered leaves have been serviceable in some forms of *cutaneous disease*. In *intermittent fever*, a strong infusion, as hot as can be comfortably swallowed, is administered for the purpose of vomiting freely. This is also attended with profuse diaphoresis, and sooner or later by an evacuation of the bowels. During the intermission, the cold infusion or extract is given every hour as a tonic and antiperiodic. It is not well adapted to ordinary cases of *ague* which may be cured with quinine, but is more particularly useful in the irregular cases which that drug does not seem to reach. The chill and succeeding fever is slight, the skin dry, and not, as a rule, followed by perspiration; there are "pains in the bones, præcordial oppression, and great thirst. If, however, the case is one in which the fever lasts all day, a slight sweating may follow at night. Another indication in ague is vomiting, especially of much bile" (Locke). Eupatorium given as above, or sometimes in small doses, may relieve *headache* of intermittent character when the intermissions are irregular. In *epidemic influenza* the warm infusion is valuable as an emetic and diaphoretic, likewise in *febrile diseases*, *catarrh*, *colds*, with hoarseness and pleuritic pains, and wherever such effects are indicated. In *influenza* it relieves the pain in the limbs and back. Its popular name, "boneset," is derived from its well-known property of relieving the deep-seated pains in the limbs which accompany this disorder, and *colds* and *rheumatism*. Often this pain is periosteal, and if neuralgic in character, or due to a febrile condition, eupatorium will relieve it. But it is not a remedy for periosteal pain due to inflammation or to organic changes in the periosteum. On the other hand, when given until the patient sweats, and then continued in 5-drop doses of specific eupatorium, it has relieved the severe *nocturnal muscular* and "*bone pains*" *of syphilis*. In *pneumonia*, if an emetic is indicated in the early stage, this agent is as efficient as any that may be used; but it is of greater value in the latter stage when given as a syrup. This is kindly received by the stomach, improves digestion, and allays the irritable cough. It is a remedy for the *cough of the aged*, that cough in which there is an abundance of secretion, but lack of power to expectorate. The *cough of measles*, *common colds*, of *asthma*, and *hoarseness* are also relieved by it. Unless given in excess it acts as a good tonic to the gastric functions, increasing the appetite and power of digestion. The *stomach disorders of the inebriate* are, in a measure corrected by the use of small, tonic doses of eupatorium. Although slightly stimulant, it is of service in most *inflammatory states*, administered according to the indications given below. The warm infusion may be administered to promote the operation of other emetics. Externally, used alone or in combination with hops or tansy, etc., a fomentation of the leaves applied to the bowels has been useful in *inflammation*, *spasms*, and *painful affections*. Dose of the powder, from 10 to 20 grains; of the extract, from 2 to 4 grains; of the infusion, from 2 to 4 fluid ounces; of the syrup (1 pint of the decoction of 1 ounce of the herb sweetened with 2 pounds of white sugar), 1 to 4 drachms; specific eupatorium, 1 to 60 drops. As an emetic administer the warm infusion freely.

Specific Indications and Uses.—Pulse full and large, the current exhibiting little waves; skin full and hot with a tendency to become moist, even during the progress of fever, cough, embarrassed breathing, and pain in the chest; urine turbid and urination frequent; deep-seated aching pains in muscles and periosteum.

EUPATORIUM PURPUREUM.—QUEEN OF THE MEADOW.

The root of *Eupatorium purpureum*, Linné.

Nat. Ord.—Compositæ.

COMMON NAMES: *Queen of the meadow, Joe Pye weed, Trumpet-weed, Gravel-weed, Gravel-root, Joe-pie, Purple boneset.*

Botanical Source.—This plant is herbaceous, with a perennial, horizontal, woody caudex, with many long, dark-brown fibers, which send up one or more solid, glabrous, green, sometimes purplish stems, 5 or 6 feet in height, with a purple band at the joints, about an inch broad. The leaves are from 3 to 6 in a whorl about 6 inches apart, oblong-ovate, or lanceolate, pointed, rugosely or feather-veined, coarsely serrate, slightly scabrous, with a soft pubescence beneath along the mid-vein and veinlets, thin, soft, borne on petioles an inch long, and from 8 to 12 inches long, by 3 or 4 inches wide. The flowers are all tubular, purple or pinkish-purple, varying to whitish, and consist of numerous florets included in an 8-leaved calyx. The heads are in lax, very dense and compound corymbs of a cylindrical form, and from 5 to 10-flowered (W.—G.).

History and Description.—Queen of the meadow grows in low places, dry woods or meadows, in the northern, western, and middle states, flowering in August and September. Its trivial name, Joe Pye weed, is said to have become attached to it through an Indian of that name, who lived in New England, and employed it as a diaphoretic in low fevers. The root is the medicinal part. As found in commerce, it consists of a blackish, woody caudex, from which proceed numerous long fibers, from 1 to 3 lines in diameter; externally they are covered with a dark-brown, longitudinally-furrowed cortex, beneath which the internal portion is white, or whitish-yellow, according to its age, the last color being the oldest. It has an odor somewhat resembling old hay, and a slightly bitter, aromatic, and faintly astringent, but not unpleasant taste, and yields its properties to water by decoction, or to spirits.

Chemical Composition.—Mr. J. B. Robinson, formerly of Cincinnati, obtained what he thought to be the active principle of the root, in the form of a dark-brown, solid resin, to which he gave the name *eupatorine*. It possessed a peculiar, slightly bitterish taste, but its therapeutical virtues were not established. In 1876, Prof. J. U. Lloyd donated to Prof. Maisch a specimen of a yellow, neutral, crystallized principle from the root of *Eupatorium purpureum*. The substance was quite soluble in hot, slightly so in cold alcohol, and insoluble in water; did not unite with dilute acids and was decomposable by strong sulphuric acid. As far as known to Prof. Lloyd, it was new to science and had no medicinal value. Mr. Lloyd's method of making this principle (*euparin*) is quoted by Prof. Trimble in the *Amer. Jour. Pharm.*, 1890, p. 76. These crystals were found to be identical with a crystalline deposit afterward observed by Mr. E. G. Eberhardt in a fluid extract of the drug, and having the composition $C_{12}H_{11}O_3$. It was not identical with quercitrin or quercetin. This formula was confirmed by C. C. Manger (*Amer. Jour. Pharm.*, 1894). A complete analysis of the drug was made by Mr. F. M. Siggins (*Amer. Jour. Pharm.*, 1888, p. 121), and by Mr. G. H. Ray (*ib.*, 1890, p. 73). The latter found volatile oil, fat, wax, yellow resin, soluble in ether, albuminoids, glucose, calcium oxalate, etc.

Action, Medical Uses, and Dosage.—Queen of the meadow has diuretic, subastringent, stimulant, tonic, and antilithic properties. It has a specific action upon the renal tract, increasing both the fluid and solid constituents of the urine. As its influence upon the stomach is good, it may be used for a great length of time without ill results. While a fairly good remedy in some forms of *dyspepsia*, and *chronic mucous diseases of the gastro-intestinal tract*, its chief value lies in its efficiency in many *disorders of the urino-genital passages*. That it is a very valuable remedy in *urinary calculi* and *gravel* is admitted by many who can not believe that it has the power to dissolve the concretions. That it is serviceable is probably due to its control over *vesical irritation*, while, by its diuretic action, it may prevent the formation of these bodies. For this purpose the following preparations and doses may be used: The infusion, 1 to 2 fluid ounces; the tincture, 5 to 15 drops; specific gravel-root, 5 to 10 drops. Gravel-root has been used with excellent effect in *dropsical affections*, due to renal inaction, being especially valuable in *anasarca*. After the removal of the effusion by catharsis, this agent may be administered to restore tone to the kidneys and to stimulate the absorbents, thus preventing the reaccumulation of the effusion. From 5 to 10 drops of specific gravel-root, in a teaspoonful of water, may be given every 3 hours, provided the patient is not greatly debilitated. *Post-scarlatinal dropsy* is benefited by it.

Gravel-root is a superior remedy for many painful and irritable states of the urinary tract. Difficult and painful micturition, with frequent desire to urinate, the passage seemingly being obstructed, is an indication for this drug. It is indicated also by pain and weight in the loins, extending to the bladder, with the scanty voiding of high-colored urine, or when mixed with blood or solids. The special sedatives may be associated with it when there is vascular excitation. *Chronic vesical irritation*, a sense of heat being experienced in the bladder, and the urine milky and loaded with mucus, the deposit adhering to the vessel, are further indications for its selection. It is a remedy for *strangury*, especially that resulting from fly-blister or irritating diuretics, with shooting, darting urethral pains, vesical tenesmus, and frequent micturition. In strangury, Prof. Locke recommends a rectal injection of 30 drops of tincture of opium in starch water, followed by the free administration of infusion of queen of the meadow. Keep the patient warm, and if this treatment is not fully effective, associate with it the hot hip-bath. *Hematuria* has been well treated with it, as have also those disagreeable sensations due to recent prostatic trouble, the active stage having passed.

In that form of *urinal incontinence* of children, in which the vesical irritation is so great that the presence of a few drops of urine in the bladder causes a contraction and expulsion of the contents of the organ, give 5 drops of specific gravel-root 3 times a day, the last dose upon retiring. The same dose or the infusion will allay the *irritable bladder of pregnancy*, and the agent is not without value in *diabetes insipidus*. With the *vomiting of pregnancy* there is sometimes associated a *cough*, and at each effort at coughing a little urine is expelled. In these cases give 1 or 2-drop doses of specific gravel-root every 2 or 3 hours; if marked nervousness is a complication give pulsatilla also. It is regarded more efficient than most diuretics in *albuminuria*. As a remedy for *chronic urinary disorders* it is a very useful agent, and fulfils many important indications.

Queen of the meadow is asserted to be of value in *gout* and *rheumatism*. In those subject to *chronic cough*, associated with a weak circulation, and in individuals suffering from *asthma*, *chronic catarrh*, and unduly prolonged *whooping-cough*, it has rendered very good service.

Impotence is somewhat improved by the use of gravel-root, and in female disorders it is quite an important remedy. It controls *chronic irritability of the womb* and is beneficial in atonic states of that organ. When *habitual abortion* is due to *prolapsus*, *retroversion*, *debility* resulting from *chronic inflammation*, or other atonic states of the uterus, the tendency may be corrected by administering 5-drop doses of specific gravel-root 3 times a day. Used as an injection alone, or with some other astringent, it is of service in *chronic amenorrhœa*, with great debility and a continuous *leucorrhœal flow*. Dose of the decoction of queen of the meadow is from 2 to 4 fluid ounces, 3 or 4 times a day; of the tincture (℥viij to alcohol, 98 per cent. Oj), 1 to 30 drops; of specific gravel-root, 1 to 30 drops, every 1 to 4 hours.

Specific Indications and Uses.—Vesical irritation; incontinence of urine; painful and frequent urination; urine scanty and milky, with mucoid or bloody admixture; uric acid diathesis; pain and weight in the loins extending to the bladder; skin hot, dry, and constricted.

Derivatives and Related Species. EUPURPURIN. This is a member of the list of remedies once known as resinoids or concentrations. Being of an oleaginous nature it was included with the *oleoresins*. The late Mr. William S. Merrell first prepared this oleoresin, and named it. It may be obtained by adding the alcoholic tincture of the root to twice its volume of water.

and distilling off the alcohol, similar to the process for obtaining resin of podophyllum, oleoresin of blue flag, etc., or better, by concentrating the alcoholic percolate of the drug by distillation and then pouring the thick residue into cold water. It is of a thick, pilular consistence and a dark greenish-brown color, having a faint peculiar smell, and a slightly nauseous taste. It is soluble in alcohol, more speedily when hot. Eupurpurin, or the oleoresin of queen of the meadow, as thus prepared by Mr. Merrell, was formerly regarded a valuable agent in many *renal* and *genito-urinary affections;* in doses of 3 grains, repeated every 3 or 4 hours, it is a most powerful diuretic. It may be given in pill form, either alone or combined with an equal quantity of castile soap. An excellent pill for many renal affections is composed of eupurpurin, 30 grains; extract of geranium, 20 grains; and extract of nux vomica, 1 grain. Divide into 10 pills. One of these pills may be given every 4 hours daily. Eupurpurin is scarcely ever employed at the present day, having given place to the more representative liquid preparations of the plant.

Eupatorium teucrifolium, Willdenow (*Eupatorium verbenæfolium*, Elliott); *Wild horehound, Rough boneset.*—This is an indigenous, perennial plant, with an herbaceous, paniculate, pubescent stem, growing from 2 to 3 feet high, with fastigiate, corymbose branches above. Leaves opposite, sessile, distinct, ovate-oblong, ovate-lanceolate, rough, veiny, lower ones coarsely serrate toward the base, upper ones alternate, subserrate, often entire. Branches of the corymb, few, unequal. Flowers small, white, consist of 5 florets within each calyx; scales of the involucre oblong-lanceolate, rather obtuse, at length shorter than the flowers (W.—G.). This plant grows in moist places from Canada to Florida, flowering in September and October. The whole plant is medicinal, possessing properties analogous to boneset, but not so unpleasantly bitter. Its active properties are taken up by alcohol or hot water. Tonic, diaphoretic, diuretic, and laxative. Recommended by Dr. Jones, of Georgia, in *intermittent* and *remittent fevers.* It stimulates the sympathetic functions, and improves digestion and blood-making. Usually administered in infusion; 1 ounce of the dried leaves infused in a quart of water, of which half a teacupful may be given every hour or two, as warm as can be comfortably drank. It will prove diaphoretic or diuretic, according to the temperature in which the patient is kept, and likewise laxative. The cold infusion, or tincture, is tonic. The dose of a strong tincture ranges from 1 to 20 drops.

Eupatorium aromaticum, Linné; *White snake-root, Aromatic eupatorium, Hemp-weed.*—This is a perennial plant, with a rough, slightly pubescent stem, about 2 feet in height, corymbose at the summit. Leaves from 2 to 4 inches long, about ½ as wide, on petioles not quite an inch long, opposite, subcordate, lance-ovate, acute, 3-veined, obtusely serrate, smoothish, or very slightly pubescent. Involucre simple, pubescent; scales of the involucre nearly equal, in one row; flowers white, aromatic, in small corymbs; heads large, 10 to 15-flowered (W.). This is an indigenous plant, growing from Massachusetts to Louisiana, but especially throughout the middle states, and flowering in August and September. The root is the medicinal part, and should be collected in September and October. It has a pleasant aromatic odor, and a bitterish taste. Its virtues are extracted by boiling water. An aromatic body, very much resembling *coumarin*, if not that principle itself, has been obtained from this plant, and also from *Eupatorium incarnatum*, Walter. Twenty-five grains of volatile oil were obtained by Chas. H. Blouch from 5½ pounds of the rhizome of Eupatorium aromaticum (White snake-root) by distillation with water (see *Amer. Jour. Pharm.*, 1890, p. 124). Diaphoretic, antispasmodic, expectorant, and aromatic. Its influence upon the brain is pronounced, relieving irritation and producing normal functional activity. Used in the form of infusion or decoction in *fevers* of a *typhoid character*, connected with wakefulness; also in *pleurisy* and *pneumonia*, as a diaphoretic and expectorant. In *hysteria*, *hypochondria*, *nervous irritability*, and *flatulence*, it is very beneficial; also reputed to have effected cures in *aphthæ*, *nursing sore mouth*, *chronic bronchitis*, and *chronic irritation of the bladder.* Dose of the infusion or decoction, from ½ fluid ounce to 4 fluid ounces; of specific white snakeroot, 1 to 30 drops, well diluted, every 2 to 6 hours. It is sometimes combined with sanguinaria and asclepias, in pulmonary diseases. Said to be valuable in *gravel.*

Eupatorium sessilifolium, Linné; *Upland boneset.*—New England, western and southern states. Open woods in dry and mountainous situations. Said to possess properties similar to, though weaker than boneset. Tonic.

Eupatorium rotundifolium, Willdenow; *Round-leaved hemp-weed; Wild horehound.*—From Canada to Texas. Infusion has been employed in *phthisis.*

Eupatorium ageratoides, Linné; *White snake-root.*—Rich woods of Canada and the United States. Diuretic, diaphoretic, and antispasmodic.

Eupatorium hyssopifolium, Linné, and *Eupatorium leucolepsis*, Torrey and Gray, both called "*Justice's weed,*" have been used with success for curing the *bites of snakes* and *poisonous animals.* They were employed for this purpose by John Justice, of South Carolina, in 1800, who received a premium for disclosing his remedy. The former grows in dry situations from Massachusetts west and south; the second in the sands from Long Island south.

Eupatorium cannabinum.—Europe. Cathartic.

Eupatorium aya-pana.—Brazil. Leaves once much used as an aromatic, bitter tonic; resembling in properties the *Eupatorium perfoliatum*, though weaker in action.

Eupatorium villosum, *Bitter-bush.*—Jamaica. Stimulant, bitter, and tonic. Employed in low stages in *zymotic disorders* as a general tonic. It is also used in the making of beer in Jamaica.

Mikania Guaco, Willdenow. *Nat. Ord.*—Compositæ. This is a South American climbing vine, closely allied to the Eupatoriums. The leaves are supposed, by the natives, to be a remedy for the *bites of poisonous serpents*, a property which they also attribute to Eupatorium ayapana. The leaves of *Mikania scandens*, an herbaceous twiner, common to the eastern United

States, probably possess similar properties. This plant has been employed in *scrofula*, in certain *cutaneous maladies*, in *chronic rheumatism*, in *diarrhœa*, and in *cholera infantum*. It has been administered in decoction, in syrup, and in fluid extract; the dose of the latter being from 15 to 60 minims, 3 or 4 times a day. Age impairs the virtues of the plant. Dr. Hancock denies that this is the correct counter-poison, *guaco*, which he states is an Aristolochia.

Ageratum conyzoides. Brazil. Reputed emmenagogue (Barker Smith).

MATA.—A Texan herb, probably the *Eupatorium incarnatum*, Walter. In New Mexico it is smoked with tobacco, and, having in itself a tonka odor, is said to modify the disagreeable odor of stale tobacco smoke, as taken up by garments and apartments (see *Amer. Jour. Pharm.*, 1868). An aromatic principle, resembling, if not identical with *coumarin*, has been obtained from *Eupatorium incarnatum*, Walter.

EUPHORBIUM.—EUPHORBIUM.

A gum-resin from *Euphorbia resinifera*, Berg.

Nat. Ord.—Euphorbiaceæ.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 240.

Botanical Source.—This leafless, cactus-like plant is a glaucous perennial growing 6 feet or more in height. Its ascending stems are fleshy and 4-angled, each side of the stem about 1 inch in width. The stems have spreading branches whose angles are clothed with divergent, horizontal stipules of a spinescent character taking the place of leaves. These are arranged in pairs and converge at the base into an ovate, somewhat triangular disc; above each pair of spines is a depressed spot indicative of a leaf-bud. The flowers, which are borne on stalks on the summits of the branches, are 3 in number, 2 of them being borne on pedicles. The branches abound in a milky juice, which exudes and concretes on the surface of the plant when it is wounded.

History.—Formerly it was not positively known from what plant this gum-resin was obtained, though Pereira believed it to be the *Euphorbia canariensis*, of the Canary Isles. From investigations by Berg, however, this view would seem to be erroneous, and the latter has established beyond doubt the true source of the drug, and has given us a full botanical description and figure of the plant in question, *Euphorbia resinifera*, Berg. It grows in Morocco, among the Atlas Mountains, and was well known to the ancients, as both Dioscorides and Pliny gave accounts of the collection of the resin on Mt. Atlas, and made notes of its extremely acrid properties (*Pharmacographia*). The drug is collected by making incisions into the stems, from which the milky fluid exudes and concretes on exposure to the air, incrusting the surface and particularly the spines in its downward flow. Finally, toward the latter part of the summer, it is gathered by the collectors, who are compelled to protect themselves from its irritating, acrid dust, by enveloping the mouth and nostrils with a cloth (see *Euphorbia corollata* for further history).

Description.—In commerce euphorbium is found in irregular, yellowish, or brownish, slightly friable tears, of a wax-like appearance, often perforated with 1 or 2 holes, united at the base, and usually mixed with the prickles of the plant and other impurities. They have hardly any odor, and that slightly aromatic, and a feeble taste, succeeded by considerable heat and persistent acrimony. Euphorbium is partially dissolved by water, forming a milk-like fluid when rubbed up with it; its best solvents are alcohol, ether, and oil of turpentine. Euphorbium must be powdered with great caution, as it excites violent sneezing, and even inflammation of the eyes. Thrown on the fire, euphorbium melts, swells, and burns with a pale flame, evolving an odor-like that of benzoic acid.

Chemical Composition.—Euphorbium, according to Henke (*Archiv. der Pharm*, 1886, p. 729), consists of resin soluble in ether (26.95 per cent), resin insoluble in ether (14.25), *euphorbon* (34.6) *caoutchouc* (1.1), malic acid (1.5), gum, salts (20.40), and ammonia-soluble matters (1.2). The intense acridity of the drug is due to the ether-soluble *resin*, which melts at from 42° to 43° C. (107.6° to 109.4° F.). The resin insoluble in ether melts between 119° and 120° C. (246.4° and 248° F.). *Euphorbon* ($C_{13}H_{22}O$, Flückiger; $C_{15}H_{24}O$, Hesse; $C_{20}H_{36}O$, Henke), was first obtained in an impure state by Dragendorff and Alberti, in 1864, and was four years later given its name and prepared pure by Flückiger (Wittstein's *Vierteljahresschrift*, 1868, p. 89). It is a crystallizable substance, fusing at 68° C. (154.4° F.), (Henke), and yields upon treatment with phosphorus pentoxide, certain hydrocarbons, as *heptane* (C_7H_{16}), *octane* (C_8H_{18}), and *paraxylene* ($C_6H_4[CH_3]_2$)

It is soluble in ether, benzin, benzene, chloroform, amylic alcohol, acetone, hot alcohol, and glacial acetic acid; almost insoluble in hot water, and precipitable by tannic acid. Henke prepared it by extracting the gum with petroleum ether and purifying the crystalline *euphorbone* thus obtained by dissolving it in ether, adding alcohol to permanent turbidity, allowing the yellow resin to subside, evaporating the clear liquid and crystallizing from benzin. It is tasteless, of neutral reaction, dextro-rotatory, and is not affected by diluted acids nor by alkalies. A *bitter* principle is also present, and may easily be obtained by boiling an alcoholic extract of the gum with water. This dissolves the bitter principle together with some of the acrid resin. The existence of Buchheim's bitter *euphorbic acid*, obtained (1875), by evaporating the acrid resin with alcoholic caustic potash, and precipitating with a diluted acid, is doubted by Flückiger and Henke (Flückiger, *Pharmacognosie*, 1891).

Action, Medical Uses, and Dosage.—Emetic, cathartic, and errhine. Seldom, however, used for these properties, on account of its severity of action. Its principal use is externally as a rubefacient or vesicant. The following preparation forms an excellent counter-irritant: Take of powdered euphorbium ½ drachm, coarsely powdered cantharides and mezereon bark, of each, 2 drachms, rectified spirits of wine 2½ fluid ounces. Mix together, digest for 8 days, then press and filter, and to the filtered tincture add, white colophony 1 ounce, white turpentine 6 drachms. With this preparation, paper or silk may be coated three separate times, by means of a soft sponge, and, when dry, forms an excellent irritating plaster for *rheumatic*, *gouty*, and *neuralgic pains*. Powdered euphorbium is frequently added to the compound tar plaster to render it more active.

Related Species.—Hura, *Sand-box tree.* Two species of *Hura*, the *Hura brasiliensis.* Willdenow, and *Hura crepitans*, Linné, both of the *Nat. Ord.*—Euphorbiaceæ, furnish medicines. The latter is indigenous to Central and South America, and to the West Indies. It is known as *ajuapar*. The seed capsules break with violence, scattering the seeds, which are used in Mexico under the name *habilla* or *pepita de San Ignacio*, as a drastic cathartic. They have a pleasant, sweet taste. The leaves, after being prepared in oil, are applied in *rheumatism*. An acrid, milky juice is obtained from the tree. This juice, as well as the seeds and bark, is emeto-cathartic, acting somewhat like the euphorbiaceous plants in general. The *Hura brasiliensis* is known in South America as *assacou* or *ussacu*. It differs from the preceding in having oblong, in place of ovate catkins. The bark *casca de assacou*, like to the first species, is acrid. The acrid principle of *Hura* has been named *hurin*. It is a crystallizable body obtained by precipitating with water an alcoholic extract of the evaporated milky juice, and dissolving the resinous matter in ether. When heated it volatilizes in acrid vapors. Nitrates and malates are likewise present. The seed integuments contain tannin, gallic acid, and coloring substance, while the kernel yields albumen, solid fatty matter, salts, and a purgative fixed oil, which alcohol dissolves. The Brazilians use it as a remedy for *elephantiasis* or *leprosy*. Even the decoction may vesicate. It is powerfully irritant to the gastro-intestinal tract, producing violent emeto-cathartic effects. It is probably ineffectual, though mitigation of the disease, but not a cure, is reported from its use.

Manchineel.—The *Hippomane Mancinelli*, Linné, a West Indian tree possesses poisonous properties. Its fruit, resembling in color and size our common apple, is said to poison fish when placed in the water. The tree abounds in acrid, milky juice, the poisonous principle of which is volatile. Fat, resin, caoutchouc, volatile oil, gummy material, and *mancinellin* are, according to Ricord-Madianna, constituents of manchineel. The juice of the tree is highly irritating, causing vesication, and if in contact with the conjunctiva, producing a violent conjunctivitis. The Indians poison arrows with it; even sleeping underneath the tree is said to produce swelling of the body. Both the juice and the fruit produce inflammatory gastro-intestinal symptoms, with emeto-catharsis.

EUPHORBIA COROLLATA.—LARGE FLOWERING SPURGE.

The bark of the root of *Euphorbia corollata*, Linné.

Nat. Ord.—Euphorbiaceæ.

Common Names: *Large flowering spurge*, *Blooming spurge*, *Milk purslane*, *Snake milk*, etc. (see *History*).

Illustration: Meehan's *Native Flowers*, Vol. I, p. 109.

Botanical Source.—This plant has many common names, and in some sections is improperly called *Bowman's root.* It is a perennial plant, with a round, slender, erect stem, 1 or 2 feet high, generally simple and smooth. The root is yellowish, large and branching. The leaves are scattered, sessile, oblong-ovate, or linear, entire, flat or revolute at the margin, smooth in some plants, very hairy in others, verticillate and opposite in the umbel, and from 1 to 2 inches in length. The flowers are in large, terminal umbels, with a corolla-like involucre, which is large, white, and showy. The umbels are 5-rayed, supported by as many bracteal leaves; not infrequently a small axilliary branch or two arises from the sides of the stem below the umbel. The rays of the umbels are repeatedly trifid or dichotomous, each fork attended by 2 leaflets and a flower. The involucre is large, rotate, white, with 5 obtuse, petal-like segments; at the base of these divisions are 5 interior, very small, obtuse segments. Stamens 12; a great portion of the plants are wholly stamniferous. The fruit is a smooth, 3-lobed, 3 celled capsule; the cells are 1-seeded, and the seeds smooth (L.—W.).

History.—Though not extensively used in medicine, many of the Euphorbias are consumed in the Eclectic practice. That some of them are excellent remedies, and could well take the place of some other extensively used drugs, there can be no doubt. The *Euphorbia Ipecacuanha* and *Euphorbia corollata* are old Eclectic drugs, while the *E. hypericifolia* was reintroduced, in 1874, by Dr. H. L. True (*Eclectic Medical Journal*, 1874), having been previously mentioned in the *American Dispensatory*. Though but little used, these drugs have staggered under a load of popular appellatives, some of them being peculiar to each plant named, others being shared by plants bearing no relation to the *Euphorbias*. *Euphorbia Ipecacuanha* is called *wild ipecac* and *ipecacuanha spurge; E. corollata—blooming spurge, large flowering spurge, milkweed, snake's milk, hippo, picac, purge root, milk purslane, emetic root, apple root, Indian physic, ipecac, ipecacuanha* and *Bowman's root; E. hypericifolia—large spotted spurge, garden spurge, black purslane, milk purslane, eye bright*, and *fluxweed; E. pilulifera—pill-bearing spurge, asthma-weed* and *snake-weed*. In view of this mass of confusing popular names, the physician will recognize the necessity of adhering to the botanical appellations for these plants.

There are many other species of Euphorbia, though all possess widely diverse characteristics from those of our medicinal plants. In the dominions of the Mauritanian despot the plants abound as large succulent trees or bushes resembling cacti, but differing from them in having a milky juice, which exudes on the slightest puncture. Nearly all the Euphorbias are more or less poisonous, and all exude this acrid milky fluid when broken. Like their fellow of the same natural order, the *Ricinus communis*, or *Castor oil plant*, most of them have cathartic powers, though some are astringent. An ornamental species, originally from Mexico, whose floral bracts are often 4 or 5 inches long and of a bright vermilion color, is familiar to flower lovers as "*fire on the mountain, painted leaf, Mexican fire plant*, or *poinsetta*" (*E. heterophylla*). In Africa *gum euphorbium* is gathered from the *E. resinifera*. Incisions are made into the stems from which the juices flow freely. From its acridity great care must be exercised by the gatherer, as it produces a violent rhinitis. A species (*E. Tirucalli*) is in common use around Madras for hedging purposes. The leaves, which are used as vesicants, will not be partaken of by cattle. *E. Lathyris* was ordered by Charlemagne to be cultivated in all monastic gardens on account of the value of its purgative seeds. Two species, the *E. hybernica* and *E. piscatoria*, will stupefy fish, a small quantity serving to render the waters of a river poisonous to fish for a long distance down the stream. Though poisonous in the raw state, the *E. edulis* and *E. balsamifera* when boiled, may be eaten as pot-herbs, and the *E. Cattimandoo* furnishes a caoutchouc. In hot countries the milk of a certain species is employed as a caustic, while another furnishes the natives with an "arrow poison" by simply dipping the weapon in the milky juice. Anthelmintic properties are possessed by the *Euphorbia thymifolia*, Linné, of India.

The scientific name *Euphorbia* is said to have been given to this genus of plants by a celebrated African monarch, King Juba of Mauritiana. This king was the son of the partisan Juba, of the wars of Pompey and Cæsar. It is claimed that he was exceptionally learned and had some knowledge of botany and medicine. Having found purging properties in a plant growing in his dominion, he called the attention of his renowned court physician, Euphorbus, to it and named it in his honor—*Euphorbia*. The trivial name, spurge, seems to have arisen from the reputed property given by King Juba, as it is but a contraction of "espurge," a French term meaning to purge.

One of our early botanists, Nuttall, had a peculiar dislike to the *Euphorbias*, and could see no good in them, regarding them as dangerous and needless remedies. Rafinesque, who was more nearly Eclectic than any other of the earlier botanists, and whose views were those generally accepted by the Eclectic fathers, says of the *E. corollata* that it is a safer and better emetic than common ipecac, from the fact that its action may be regulated according to the quantity taken, which, as we all know, can not be done with the latter drug. This uncertainty is particularly noticeable in fluid preparations of ipecac. Rafinesque further notes the singular similarity of the Louisiana Indian name "*pekeca*" and the Brazilian "*ipeca*," both meaning "*emetic root*." Barton considered the *E. ipecacuanha* of equal value to ipecac, besides possessing the advantage of having but little taste and odor.

Euphorbia corollata is found in dry fields and woods throughout portions of Canada and the United States, flowering from June to September. The milky juice, which exudes freely from all parts of the plant when bruised, proves very irritating to the cutaneous structures, and, if kept in contact sufficiently long, will cause pustulation and even vesication. The root, or part used, when dried, is odorless and nearly tasteless.

Description and Chemical Composition.—The root is from ⅓ of an inch to 1 or 2 inches in diameter, 1 or 2 feet in length, odorless, and nearly tasteless, producing a pungency in the mouth and fauces after having been chewed for some time. It should be gathered in the fall. The bark of the root is the medicinal part. It is from ¼ to 1½ inch in thickness, constituting the major part of the root, and imparts its properties to alcohol or water. It forms a light, brownish-yellow powder, speckled throughout with innumerable fine dark spots, somewhat resembling a mixture of fine pepper and salt, with the exception of color. Dr. Zollickoffer found it to contain resin, mucilage, and caoutchouc. It is possible, if not probable, that *euphorbon* is present, as it has been found in the *E. Ipecacuanha*. Kino and catechu are incompatible with this plant; when united with either, the medicinal powers of the Euphorbia are destroyed, while the astringency of the kino or catechu becomes entirely altered. Probably all vegetable astringents are incompatible with the agent under consideration. Opium interferes with its emetic operation, and should not, therefore, be given in combination with it, when emesis is desired. Acetic acid also interrupts its emetic influence, causing it to pass off by the bowels (*Amer. Jour. Pharm.*, Vol. V, p. 166).

Action, Medical Uses, and Dosage.—Euphorbia is emetic, diaphoretic, expectorant, and epispastic. Small doses are expectorant and diaphoretic. Larger doses produce emesis usually without much pain or spasm, nausea or giddiness. Overdoses will produce dangerous hyperemesis, or hypercatharsis, or both, and not infrequently give rise to an unpleasant inflammatory state of the alimentary canal. A dose that falls short of emesis usually proves cathartic.

Fifteen or 20 grains of the powdered bark of the root will excite emesis. Four grains of the powdered root bark, given every 3 hours, will act as a diaphoretic; or the compound powder of ipecacuanha and opium may be employed for the same purpose, substituting the E. corollata for the ipecacuanha. In doses of 3 grains, exhibited occasionally in a little honey, syrup or molasses, it operates as a useful expectorant, and may be administered in all cases where such action is desired. Even when given in large doses, it is apt to induce inflammation of the mucous coat of the stomach and bowels, with hypercatharsis. Occasionally, when given as an emetic or cathartic, it causes distressing nausea, with considerable prostration. From 4 to 10 or 12 grains generally act as a cathartic.

The principal use to which this drug was put by the early Eclectics was as an emetic or emeto-cathartic in *dropsical conditions*, but undoubtedly we possess better agents in this class of affections in digitalis and the apocynums. An emetic dose was given 2 or 3 times a week for *hydrothorax* and *ascites*. As an emetic, it should never be employed where there is great debility or when an inflammation of the digestive organs is present. It has been employed with success in *amenorrhœa*. It has a direct action on mucous surfaces, and, when given in small doses is valuable to check inflammatory action of the stomach and bowels. Small doses relieve irritation, promote digestion, and increase functional activity. It rectifies irregularity of the bowels and rarely fails to overcome constipation if used as indicated. It is often indicated in *diarrhœa* and *dysentery*, especially the so-called bilious forms. *Chronic bronchitis* and *laryngitis*, with profuse mucous discharges, have been cured by it. Prof. King used it in several cases of *partial deafness* with tinnitus from extension of *chronic catarrhal inflammation of the nares* and *throat* to the Eustachian tubes. It is also indicated (in small doses) in *catarrhal inflammations* with abundant mucous discharges, and especially if the patient be debilitated. For this purpose it has served a good use in *vesical catarrh*.

Dose of the powder as an emetic, 15 to 30 grains, every 15 minutes; tincture (emetic), 15 to 60 drops, every 15 minutes; for specific uses, tincture, fraction of a drop to 10 drops; specific euphorbia, $\frac{1}{16}$ to 10 drops.

Specific Indications and Uses.—Indications for both this drug and for *E. Ipecacuanha* are long-continued gastric irritation, irritative diarrhœa, dropsy with irritation of mucous tissues, and catarrhal discharges with debility. Tongue elongated and pointed with prominent papillæ, uneasy sensation in the stomach; cholera infantum with hot and tender abdomen, constant desire to defecate, with greenish irritating stools.

EUPHORBIA HYPERICIFOLIA.—LARGE SPOTTED SPURGE.

The entire plant *Euphorbia hypericifolia*, Linné.

Nat. Ord.—Euphorbiaceæ.

Common Names: *Large spotted spurge, Garden spurge, Black purslane, Milk purslane, Eye-bright, Flux-weed.*

Botanical Source and History.—Euphorbia hypericifolia is a common weed, found in gardens and on cultivated land, in all parts of the United States. The stem is from 1 to 2 feet in length, ascending, and much branched; it is smooth, and when the plant grows in sunny situations, is of a purple color. The branches are alternate, and proceed from opposite sides of the stem, giving the plant a flat appearance. The leaves are about an inch long, opposite, unequal at the base, and supported on very short leaf-stalks; they are oblong, obtuse, triple-veined from the base and serrulate, with numerous small, appressed teeth. The larger leaves have large purple spots near the center, which is very characteristic of the plant. The flowers are small, inconspicuous, and appear late in summer. They have the peculiar structure of the genus *Euphorbia*, and the involucrate clusters are borne from the forks of the branches on slender stalks about $\frac{1}{4}$ inch long. The fruit is a 3-lobed carpel, containing 3 wrinkled, blackish seeds. The plant is minutely described in earlier editions of this *Dispensatory*, as follows: "This plant, also known by the names of *Black purslane, Milk purslane, Eye-bright*, etc., is an annual plant, with a smooth, somewhat procumbent, branching stem, from 1 to 2 feet high; branches dichotomous, divaricate-spreading. Leaves from $\frac{1}{2}$ to 1 inch in length, about one-fourth as wide, opposite, oblong, somewhat falciform, serrated, oblique or heart-shaped at base, often curved, 3 to 5-ribbed underneath, on very short petioles, often marked with purple oblong dots and blotches. Flowers small, white, numerous, disposed in terminal and axillary corymbs. Fruit mostly rather hairy; seeds 4-angled, obscurely wrinkled transversely" (W.—G.).

History and Chemical Composition.—*Euphorbia hypericifolia* is an indigenous plant, growing in rich soil in waste and cultivated places, as old cornfields, but seldom in woods, and flowering from July to September. The whole plant is used, and yields its properties to water or alcohol; the leaves have a sweetish taste, succeeded by a sensation of harshness and roughness. The plant contains caoutchouc, resin, tannin, gallic acid, etc. (Wm. Zollickoffer, 1833). No further analysis or chemical examination seems to have been made. Dr. H. L. True brought this drug forward in the *Eclectic Medical Journal*, 1874, since which time numerous articles have appeared in various medical journals, and at present the plant is in regular use among Eclectic physicians, having obtained a reputation in the treatment of bowel disorders.

Action, Medical Uses, and Dosage.—Garden spurge acts principally upon the digestive tract and the sympathetic nervous system. Dr. True, its introducer, proved the remedy upon himself, using an infusion of leaves and tops (℥ss to water Oj). He took $1\frac{1}{2}$ pints of the infusion at one dose. Shortly afterward, he experienced a fullnesss in the frontal and parietal regions, followed by a headache similar to that produced by macrotys, but less severe. The pain then centered at the top of the head and a characteristic heat was felt over the eyes. The mind could not be fixed upon anything but the headache. There was no tinnitus nor vertigo, nor was sleep produced, though a feeling of drowsiness and languor superseded the active stage. The maximum effect of the drug was produced in about 2 hours and subsided in $3\frac{1}{2}$ hours. An unpleasant fullness with oppression at the epigastrium accompanied the head symptoms. The drug proved so constipating that he was obliged to take physic the following day. He concluded that in large doses it acted primarily as a cerebral stimulant, and secondarily as a sedative to the brain and sympathetic nervous system. In no sense could it be called a narcotic. Dr. True found this drug to be very efficient as an injection for *gonorrhœa*, using it in several cases, some of them chronic, with complete success. The principal use, however, for which the drug was brought out, was for *gastro-intestinal disorders.* It is one of the most certain remedies for *cholera infantum*, having been employed where ipecac proved useless. *Typhilitis*, *muco-enteritis*, *dysentery*, and *irritant diarrhœa* are also cured by it when its indications are present, which are gastric irritation, or irritation of any portion of the mucous lining of the intestines. It is usually employed with specific aconite. It has been found of service in *menorrhagia* and *leucorrhœa*, both from debility, and is recommended for *infantile pneumonia* and *bronchitis.* It is also valuable in *summer complaints of adults.* Excellent results have attended its employment in *cholera morbus.* Its most marked property is that of removing gastro-intestinal irritation. The dose of the strong infusion of the plant (℥ss to boiling water Oj, infused $\frac{1}{2}$ hour) is, for a child, from 15 minims to 2 fluid drachms every hour; for an adult, from a teaspoonful to a tablespoonful every hour. Dose of specific spotted spurge, 1 to 10 drops in water every 1 or 2 hours.

Specific Indications and Uses.—Gastro-intestinal irritation; cholera infantum; muco-enteritis; dysentery; vertigo, with constipation; "diarrhœa, the discharges being greenish and irritant; frequent desire to go to stool, which relieves sometimes without any motion" (Scudder).

Related Species.—*Euphorbia maculata*, Linné, or *Spotted spurge*, is possessed of similar properties, and has been used with advantage in the same forms of disease, *cholera morbus*, *diarrhœa*, *dysentery*, etc. It is an annual plant, generally found growing with the *E. hypericifolia*, and possesses sensible properties analogous to those of this variety. It has a procumbent stem, spreading flat on the ground, much branched, and hairy; leaves opposite, oval or oblong, minutely serrulate toward the end, unequal at the base, slightly 3-ribbed, smooth above, hairy and pale beneath, oblique at base, on short petioles, often spotted with dark-purple, from 3 to 6 lines long, one-half as wide. Flowers white, solitary, axillary, much shorter than the leaves, appearing from July to October; female flowers naked. Filaments articulated; receptacle squamose; capsule 3-grained, smooth, pubescent, or warty; seeds 4-angled, obscurely wrinkled transversely, about one-third smaller than the *E. hypericifolia* (W.—G.). Zollickoffer, in 1842, found resin, caoutchouc, and gallic and tannic acids in this species.

Euphorbia prostata, Aiton, *Swallowwort*, a plant growing in the southwestern portions of the United States and Mexico, is one of the many so-called specifics against the *bite of the rattlesnake*, and other *poisonous reptiles*, *spiders*, etc. It is known to the natives of Mexico as *gollindrinera.* The fresh juice of the plant is procured by bruising it in a mortar, and then adding water and expressing it; the dose is 3 or 4 fluid ounces, repeated every 1, 2, or 3 hours, or oftener, according to the urgency of the case; the bruised plant being at the same time applied to the wound. The plant grows in dry, hard, sandy soils, has long, thread-like, reddish stems, resembling somewhat the Coptis trifolia, and which become entangled with each other; leaves opposite, dark-green, obcordate, petaloid, from $\frac{1}{3}$ to $\frac{1}{2}$ inch long; flowers appear from April to November, are small, white, axillary, dark-purple at the orifice of the corolla tube; sepals 4; petals 4; root large, deep-brown. The whole plant contains an abundance of an odorless, insipid, milky juice.

Euphorbia humistrata, Engelmann.—Mississippi valley. Resembles the preceding species.

Euphorbia chiliensis, of Chili.—Is employed as a drastic cathartic.

Euphorbia ocellata, Dur. and Hilg.—Pacific states. Contains gallo-tannic acid and resin. Used to antidote *snakebites.*

Euphorbia lata, Engelmann.—United States. Cases of poisoning by seeds, reported near Philadelphia, by Harlan, producing serious gastro-intestinal disturbance, with excessive catharsis, followed by dilatation of pupils and stupor (*Med. and Phys. Researches*, p. 603).

Euphorbia Lathyris, Linné (*Tithymalus Lathyris*, Scopoli); *Caper* or *Garden spurge.*—A native of the south of Europe, but cultivated and somewhat naturalized in the United States, having been introduced into New Mexico and western Texas (Coulter). The seeds, which were formerly used under the name of *semen cataputiæ minoris*, yield an expressed oil which is purgative, and deposits a crystalline mass upon standing. O. Zander obtained 42 per cent of oil by extraction with carbon disulphide (*Amer. Jour. Pharm.*, 1878, p. 339). *Æsculetin* ($C_9H_6O_4$), is also one of its constituents (R. Tawara, *Chem. Ztg.*, 1889, p. 1706). Five seeds have been known to purge, and also to provoke emesis. It is said to act somewhat like croton oil. In doses of 5 to 10 drops the pure oil is said to act mildly, but is liable to assume dangerous acrid properties. When recent the oil is without odor, colorless, and practically tasteless. Cases of poisoning by the seeds have been reported (*Bull. de Therap.*, Vol. CI, p. 541). The antidotes are opiates. The milky juice from this plant, collected in autumn, revealed under the microscope the presence of *euphorbon*, starch, and crystals of calcium malate (Henke, *Archiv. der Pharm.*, 1886, p. 753).

Euphorbia eremocarpus.—Pacific states. Contains resin, an acid, and a volatile oil. Used to stupefy fish to facilitate their capture (*Proc. Cal. Coll. Pharm.*, 1885).

Euphorbia Drummondii, Boissier.—Australia. This plant, according to Bailey and Gordon, is poisonous to sheep. It is also fatal to cattle. If eaten by them early in the morning, before the sun has dried the plant, the result is said to be nearly always fatal. Sheep will only eat it when grass is scarce. The head becomes enormously swollen, and the animal, being unable to support it, is forced to drag it over the ground. The ears also swell, and suppuration ensues. It is known to the natives as *caustic creeper*, *milk plant*, and *pox plant*. The *Euphorbia alsinæflora*, Baillon, is likewise poisonous to sheep (*Useful Native Plants of Australia*, Maiden). Dr. J. Reid (*Austral. Med. Gaz.*, No. 61), is said to have isolated a crystalline alkaloid devoid of color from *E. Drummondii*, and named it *drummine*. He ascribes to it anæsthetic properties, which property is considered by some as doubtful (see also *Amer. Jour. Pharm.*, 1887, p. 264). The entire subject of its chemistry needs verification.

Euphorbia heterodoxa, Mueller.—Brazil. This plant is known as *Alveloz*, *Aveloz*, and *Arveloz*. The juice is said to act somewhat like jequirity. When fresh it produces dermatitis, and destroys diseased tissue without producing marked pain. Spread upon a granulating sore, it produces a profusion of pus, and placed upon morbid growths destroys them, layer after layer, and induces granulation. The acrid principle seems to reside in a resin. It has been used with reputed success in the treatment of *cancerous growths* and *syphilitic chancroids*.

Euphorbia helioscopia, Linné.—Texas and other parts of the United States. The juice of this plant is said to remove *warty growths*.

Euphorbia marginata, Pursh; *Snow-on-the-mountain*.—Cultivated in gardens in the United States. Produces effects like those of poison-oak (*Bot. Gaz.*, 1890, p. 276).

MANZANILLO.—A West Indian Euphorbiaceæ, the juice of which is violently irritant, and when internally administered (20 drops), produced a fatal gastro-intestinal inflammation. It is diuretic, and in 2-drop doses is reputed actively purgative. The Cubans make use of it in *tetanus*.

Mercurialis annua (*Nat. Ord.*—Euphorbiaceæ). Europe. Reichardt, in 1863, obtained from this herbaceous plant a volatile base, *mercurealine*, which he describes as an oily base, analogous to *coniine*, of strongly alkaline reaction, possessing a penetrating, narcotic odor, and resinifying when exposed to the air. It begins to distill at 140° C. (284° F.). E. Schmidt (1878), declares it identical in every respect with *monomethylamine* (CH_3NH_2), and to be associated in the plant with small amounts of *trimethylamine*. When boiled the plant is rendered non-acrid, and is used as a poultice. It was formerly regarded an important remedy in Europe, where it was variously lauded as a purgative, diuretic, emmenagogue, and antisyphilitic. A related European species, *Mercurialis perennis*, is likewise toxic

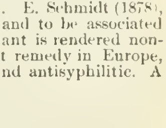
EUPHORBIA IPECACUANHA.—AMERICAN IPECAC.

The bark of the root of *Euphorbia Ipecacuanha*, Linné (*Euphorbia gracilis*, Elliott).

Nat. Ord.—Euphorbiaceæ.

COMMON NAMES: *Wild ipecac*, *American ipecacuanha*, *Ipecac spurge*, *Carolina ipecac*, *White ipecac*, *Spurge*, etc.

Fig. 110.



Euphorbia Ipecacuanha.

Botanical Source.—This is a perennial plant, with a yellowish, irregular, fleshy root, very large in proportion to the plant it bears, running deep into the sand, sometimes extending to the depth of 6 feet. The stems from one root are numerous, subereet or procumbent, smooth, thick, succulent, regular dichotomous, jointed at the forks, forming large branches on the surface of the ground, and from 3 to 12 inches long. The leaves are inserted at the joints, opposite, 1 or 2 inches long, by ¼ or ½ an inch wide, sessile, smooth, varying from oblong and circular to linear, and, in color from green to purplish. The flowers are solitary, on long peduncles from the forks of the stem, and small. Calyx spreading, with 5 exterior obtuse segments, with 5 small, gibbous, inner segments or nectaries. The stamens are numerous, in 5 parcels, appearing at different times 2 or 3 together, with double anthers. The fertile flowers have a large, roundish, drooping, pediceled germ, crowned with 6 revolute stigmas. The capsule is 3-celled, containing 3 white, areolate-pitted seeds (L.—W.—G.).

History and Description.—This is an indigenous plant, found growing in dry, sandy soils, on Long Island, in New Jersey, and the middle and southern states, and flowering from May to August. As with the *E. corollata*, it yields a milky juice, which causes a pustular eruption when applied to the skin. The root is the part used in medicine. The fresh root is from 3 to 7 feet long, tuberculated, and of a yellowish color; from ½ to 1 inch in diameter, and of a very acrid taste. The dry root is light and brittle, without odor, and has a sweetish, not very disagreeable taste (E. & V.). The powdered root is of a light-brown, or light snuff-color, speckled similar to *E. corollata*. Water or alcohol takes up its active properties. Its incompatibles are probably the same as those of the E. corollata.

Chemical Composition.—Analysis of this plant by C. Petzelt, in 1873 (*Amer. Jour. Pharm.*, p. 255), revealed the presence of resin, gum, glucose, starch in abundance, fixed oil, calcium sulphate, and other salts. The resin is dark in color, has at first a bitter taste, which subsequently becomes pungent and nauseating. This resin he believed to carry the active emeto-cathartic properties of the root. Small doses (½ grain) acted as a hydragogue cathartic, while larger doses (1½ to 2 grains) induced nausea and emesis. It is insoluble in benzin and ether, but dissolves in alcohol. The root is believed to contain a glucosid from the fact that the reaction for glucose is not apparent unless the root be first boiled with a diluted acid (Dilg, *Amer. Jour. Pharm.*, 1876, p. 485). Benzin extracts from the root, among other substances, *euphorbon* (see *Euphorbium*).

Action, Medical Uses, and Dosage.—It very much resembles the E. corollata in its action upon the system, but is less energetic. It may be employed as a substitute for it or for ipecac. It is emetic, diaphoretic, expectorant, and epispastic; and may be used in the same doses and for the same purposes as the E. corollata; in *dropsical affections* it is preferred by some practitioners. When given in cathartic doses, say from 3 to 10 grains, it is said to promote the menstrual discharge. As an emetic and cathartic, it has been found valuable in *bilious colic*, but is superseded in this disease by the Dioscorea villosa, which acts promptly and efficiently without any unpleasant symptoms. In *dyspepsia*, 1 or 2 grains, repeated 3 times daily, will be found useful. The dose of the powdered root is from 10 to 15 grains as a hydragogue; 1 to 3 grains as an expectorant and diaphoretic. It is occasionally used in *jaundice* and *obstinate torpidity of the liver*. It was formerly principally used by physicians as a hydragogue in *dropsical affections;* but, in recent years, it has been used to allay *gastro-intestinal irritation* and *inflammatory action*, as in some forms of *dysentery* and *diarrhœa*.

Specific Indications and Uses.—(Same as for *E. corollata*, which see).

EUPHORBIA PILULIFERA.—PILL-BEARING SPURGE.

The entire plant *Euphorbia pilulifera*, Linné.

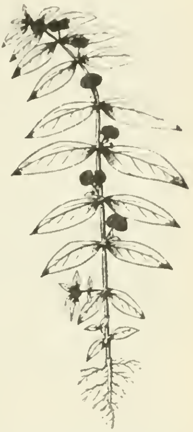
Nat. Ord.—Euphorbiaceæ.

Common Names: *Pill-bearing spurge*, *Snake-weed*, *Cat's-hair*, *Queensland asthma-weed*, *Flowery-headed spurge*.

Botanical Source.—A prostrate or ascending (erect, Coulter), pubescent, herbaceous annual, having a stem which forks at the base, bearing oblique, oblong-ovate leaves, opposite, serrate, and acute at both ends. The flower-heads, which are cymose, minute, numerous, and crowded, are borne on a stalk which proceeds from only one leaf-axil. The involucres are minute and arranged in dense, short-stalked clusters, which are terminal. The gland-appendages are narrow or obsolete. The fruit is an acute-angled, hairy pod, inclosing the reddish 4-angled, transversely rugulose seeds.

History and Chemical Composition.—This plant is found in most tropical and subtropical regions. In the United States it grows throughout the gulf states to Texas and New Mexico (Coulter). This plant reaches a height of 10 to 15 inches, and has a red, fibrous root. The stalk, which is reddish, is covered with peculiar yellowish hairs. It grows well in almost any soil, and, in some countries, is a wayside weed and difficult of extermination. In Australia, where it is abundant, it is much esteemed by the laity as a remedy for coughs, colds, and bronchial and pulmonary disorders in general, including asthma. Its decoction gives an acid reaction with litmus paper. Chas. G. Levison, of San Francisco, who made a quantitative analysis of the plant (*Amer. Jour. Pharm.*, 1885, p. 147), found, among other substances, a trace of tannin, volatile substances, a non-volatile wax, salts of potassium, magnesium, sodium, and silica, starch, and several resins of a glucosidal character, differing mainly in the strength of alcohol required to accomplish their solution. Euphorbia pilulifera was introduced to the medical profession by Parke, Davis & Co., of Detroit, through whose extensive advertising it became generally known.

Fig. 111.



Euphorbia pilulifera.

Action, Medical Uses, and Dosage.—Euphorbia pilulifera is one of the tropical spurges. Its physiological effects are not pronounced, except that it is irritant to the gastro-intestinal tract, and may occasion epigastric distress with nausea. Upon other portions of the mucous surfaces and the skin it seems to be inactive. Its action is said to be confined chiefly, if not wholly, to the respiratory and cardiac centers, and elimination takes place by the liver. It is brought forward as a reliable anti-asthmatic, being particularly adapted to spasmodic forms of *asthma*. *Dyspnœa of cardiac disease* has been relieved by it. It is recommended for *chronic bronchitis* in old people. It promoted expectoration, allayed cough, and exerted an anodyne influence in a case of *pulmonary consumption*. It has likewise given good results in *emphysema*. Dose of ordinary tincture, from 10 to 60 drops, as an anti-asthmatic, for which purpose it is highly valued in Australia. The leaves may be smoked in a pipe for *paroxysmal asthma*. Infusion (℥ss to aqua Oj), ¼ to ½ fluid ounce; fluid extract, 10 to 30 drops; specific asthma-weed, $\frac{1}{10}$ to 30 drops.

Specific Indications and Uses.—Spasmodic action of respiratory muscles, with bronchial irritation.

Related Species.—*Euphorbia parviflora*. This species is mentioned merely on account of its having been used to adulterate, or as a substitute for, the above species, which it closely resembles. Its points of difference are: Less flowers in the flower-heads, minutely-papillose, obtuse seeds, and by having upon the involucral glands a white appendage, of an obovate-orbicular shape.

EUPHRASIA.—EYEBRIGHT.

The plant *Euphrasia officinalis*, Linné.
Nat. Ord.—Scrophulariaceæ.
COMMON NAME: *Eyebright*.

Botanical Source.—This is an elegant little annual plant, with a square, downy, leafy stem, simple or branched, and from 1 to 5 inches in height. The leaves are almost entirely opposite, ovate or cordate, downy, strongly ribbed and furrowed, the lowest crenate, and the floral with sharp, tooth-like serratures. The flowers are axillary, solitary, very abundant, and inodorous, with a brilliant variety of colors. The corolla varies much in size as well as in color, being commonly white, with deep purple streaks, and a yellowish palate. The upper lip of the corolla is galeate, emarginate, having 2 broad, spreading lobes; the lower lip is larger, spreading, 3-cleft, and the lobes are obtuse or notched. The calyx is campanulate and 4-cleft. Stamens 4, fertile under the upper lip; anthers violet, lower cells of the upper ones with a long spur. Pod oblong and flattened. The seeds are numerous, oblong, and grooved lengthwise (L.—G.).

History and Chemical Composition.—This is a small plant, indigenous to Europe and this country, bearing white or red flowers in July. The recent leaves are commonly employed; they are inodorous, but of a bitter, astringent taste. Water extracts their virtues. Enz (1859) examined the recent plant. He found it to contain mannit, grape sugar, volatile oil in small amount, an acrid, bitter principle, cellulose, and other plant constituents, besides a number of acids of organic character, and tannin, the latter giving a deep-green coloration with ferric compounds, and a bright light-green reaction with the salts of lead.

Action, Medical Uses, and Dosage.—Slightly tonic and astringent. Used with much benefit in the form of infusion or poultice, in *catarrhal ophthalmia;* also of service in all mucous diseases attended with increased discharges; and in *cough, hoarseness, earache,* and *headache,* which have supervened in *catarrhal affections.* It appears to specifically influence the nasal membranes and lachrymal apparatus. In *acute catarrh* (*fluent coryza*), in which there is a profuse watery flow, it exerts its most specific action. It will not only be found of great utility to control inflammatory and catarrhal phases of the parts during or following an attack of *measles,* but will tend to avert unpleasant after-effects, as *catarrhal conjunctivitis, nasal catarrh, catarrhal deafness,* etc. *Catarrhal diseases of the intestinal tract* may be treated with euphrasia. Four fluid ounces of the infusion taken every morning upon an empty stomach, and also every night at bedtime is asserted to have been found successful in curing *epilepsy.* Such extravagant statements are not calculated to inspire confidence in the use of medicines. Dose of specific euphrasia, 1 to 60 drops; the infusion (℥i to aqua Oj), 2 fluid drachms to 4 fluid ounces.

Specific Indications and Uses.—Acute catarrhal diseases of the eyes, nose, and ears; fluent coryza with copious discharge of watery mucus. "Secretion of acrid mucus from eyes and nose with heat and pain in frontal sinus" (Scudder).

EXTRACTA ET EXTRACTA FLUIDA.—EXTRACTS AND FLUID EXTRACTS.

Fluid and Solid Extracts.—Formerly these preparations were separated into two classes and were considered in different sections of the Pharmacopœia. At present they are arranged therein successively in alphabetical order, in one general class. We shall thus consider them, first prefacing the formulæ by appropriate introductory remarks.

Extracta Fluida.—Fluid Extracts. These are concentrated alcoholic liquids, and have the advantage over solid extracts in being prepared with less evaporation, and consequently less heat, whereby their activity is not so liable to impairment. With some drugs in which the medicinal virtues depend entirely upon a volatile fluid or evanescent substance, and can not be reduced to a solid extract or a dry condition, the fluid extract or a fluid representative, presents the only rational mode of drug administration. The established strength of fluid extracts preceding the *U. S. P.* of 1880, was 1 troy ounce of drug to 1 fluid ounce of the finished fluid extract. The present strength, with few exceptions, is 1000 grammes of the drug to 1000 cubic centimeters of the finished fluid extract. This deviation from the original strength is so little as to be of no consequence when taken in connection with the variation in drug quality and the personal equations of the operator and patient. For all practical purposes, there is no distinction between the therapeutical values of fluid extracts made by the old or the new pharmacopœial standards. The menstruum employed in the preparation of fluid extracts varies according to the character of the energetic constituents of the plant; thus, many agents require only enough alcohol to preserve them, while those containing oils and resins require increased alcohol according to the degree of solubility in this menstruum. Great care and attention are required in making these preparations, from the fact that too high a temperature or too long an exposure to the action of the atmosphere frequently tends to decompose and render them worthless. One trouble relative to some of the fluid extracts is their natural tendency to subsequent decomposition; the result being the formation of precipitates that often contain valuable medicinal agents. But it does not necessarily follow that the result of decomposition is always accompanied by the formation of sediments; in many cases liquids lose their therapeutic value and still remain comparatively transparent.

The terms *Essential tinctures, Concentrated tinctures,* and *Saturated tinctures* have been applied to preparations similar to or identical with fluid extracts, but they have long since been displaced by the name fluid extract, and are practically obsolete. The *U. S. P.* contains an extensive list of fluid extracts, but not as extensive as the catalogues of medicinal manufacturers. To these formulæ we have added many others, but to give formulæ for the entire line of commercial fluids is impracticable. The Pharmacopœia contains general directions for percolation that can be easily adapted to unofficial extracts, the operator selecting the menstruum that is applicable to each drug. In addition to this, the *National Formulary* contains explicit general directions for making many unofficial fluid extracts, which general directions may appropriately be introduced before the official processes, these being given in detail by us. In our opinion, both these general methods may be improved upon, in many cases, by evading evaporation altogether. The official preparations are in accordance with the metric system, but those introduced from other sources are given in troy ounce and fluid measure.

National Formulary General Directions.—EXTRACTA FLUIDA (*N. F.*), *Fluid extracts. Formulary number*, 135: "The fluid extracts for which formulas are given in this formulary, are intended to be of the same strength as the fluid extracts of the *U. S. P.*, which directs that one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of fluid extract shall be obtained from one hundred grammes (100 Gm.) [3 ozs av., 231 grs.] of the drug."

GENERAL PROCESSES.—"The fluid extracts of this formulary are to be prepared according to one of the following two processes, the particular one to be employed being designated in each case. These two processes are necessary because, in the preparation of some fluid extracts, two fluids are successively used, the first containing glycerin, and being in definite proportion to the drug used, while the second is free from glycerin, being intended for the exhaustion of the drug and subsequent evaporation. Accordingly, these menstrua are designated as *Menstruum I* (containing glycerin), and *Menstruum II* (containing no glycerin). As an alternative to either of these processes, a third process, dependent upon *Fractional Percolation* may be used. In this the use of heat is avoided, and it involves the use of only one kind of menstruum, even in the case of drugs for which two different menstrua (I and II) are prescribed in this formulary. In the case of the latter, a sufficient quantity of Menstruum I must be prepared to serve throughout the process."

PROCESS A. THE MENSTRUUM CONTAINS NO GLYCERIN.—"Moisten one thousand grammes (1000 Gm.) [2 lbs. av., 3 oz., 120 grs.] of the drug with a sufficient quantity of the prescribed menstruum to render it distinctly damp, and to maintain it so after several hours' maceration in a well-covered vessel. When the drug has ceased to swell, pack it in a suitable percolator, pour a sufficient quantity of the menstruum on top, and when the percolate begins to drop from the orifice, close the latter, cover the percolator, and allow the contents to macerate 24 hours. Then permit the percolation to proceed. Receive the first eight hundred and seventy-five cubic centimeters (875 Cc.) [29 fl℥, 282 ♏] of the percolate separately and set it aside. Then continue the percolation with the same menstruum until the drug is practically exhausted. Evaporate this second portion—at a temperature sufficiently low to prevent the loss of any important volatile constituent—to a soft extract, and dissolve this in a sufficient quantity of menstruum so that when this is added to the reserved portion, the product will measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Allow the fluid extract to stand a few days, or longer if convenient, and filter, if necessary."

PROCESS B. THE MENSTRUUM CONTAINS GLYCERIN.—"Moisten one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.] of the drug with a sufficient quantity of Menstruum I to render it distinctly damp and to maintain it so after several hours' maceration in a well-covered vessel. When the drug has ceased to swell, pack it in a suitable percolator and pour the remainder of Menstruum I on top. When this has just disappeared from the surface, follow it by a sufficient quantity of Menstruum II. As soon as the percolate begins to drop from the orifice, close the latter, cover the percolator, and allow the contents to macerate during 24 hours. Then permit the percolation to proceed. Receive the first eight hundred and seventy-five cubic centimeters (875 Cc.) [29 fl℥, 282 ♏] of the percolate separately and set it aside. Then continue the percolation with Menstruum II, until the drug is practically exhausted. Evaporate this second portion—at a temperature sufficiently low to prevent the loss of any important volatile constituent—to a soft extract, and dissolve this in a sufficient quantity of Menstruum II, so that when this is added to the reserved portion, the product will measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Allow the fluid extract to stand a few days, or longer, if convenient, and filter, if necessary."

PROCESS C. FRACTIONAL PERCOLATION.—"Take of the drug, in powder of the prescribed fineness, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.], and divide it into three portions of five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.], three hundred and twenty-five grammes (325 Gm.) [11 ozs. av., 203 grs.], and one hundred and seventy-five grammes (175 Gm.) [6 ozs. av., 76 grs.], respectively. Moisten the first portion of the drug, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.] with the menstruum and percolate in the usual manner. Set aside the first one hundred and seventy-five cubic centimeters (175 Cc.) [5 fl℥, 440 ♏] of percolate, and continue until fifteen hundred cubic centimeters (1500 Cc.) [50 fl℥, 346 ♏] more of percolate have passed, which must be received in several portions, so that the more concentrated will be separate from the last weak percolate. Then moisten the second portion of the drug, three hundred and twenty-five grammes (325 Gm.) [11 ozs. av., 203 grs.] with the more concentrated percolates received during the preceding operation, after the first one hundred and seventy-five cubic centimeters (175 Cc.) [5 fl℥, 440 ♏] have passed, and percolate again in the usual manner, using the several reserved percolates, successively, as menstrua. Set aside the first three hundred and twenty-five cubic centimeters (325 Cc.) [10 fl℥, 475 ♏], and continue the percolation until six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] more have passed, which should also be received in several portions. Finally, moisten the third portion of the drug, one hundred and seventy-five grammes (175 Gm.) [6 ozs. av., 76 grs.] with the most concentrated of the last reserved percolates, and proceed as directed for the second portion. Collect five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of percolate, and mix with the two portions (325 and 175 Cc.) previously set aside, so as to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of fluid extract. *Note.*—If this method is applied to drugs for which Process B is directed, use a sufficient quantity of Menstruum I to obtain the required quantities of percolate, and omit the use of Menstruum II."

U. S. P. General Directions for Percolation.—FINENESS OF POWDER. "The fineness of powder is expressed, in the Pharmacopœia, either by descriptive words (generally so in the case of brittle or easily pulverizable substances), or in terms expressing the number of meshes to a linear inch of the sieve through which the powder will pass. The corresponding values, in terms of metric measures of length, are added below in parentheses, but it has not been deemed advisable, in this revision, to substitute them in the text of the Pharmacopœia for those at present in use.

"These different forms of expression correspond to each other as follows:

A *very fine* powder	should pass through a sieve having 80 or more meshes to the linear inch (30 meshes to the centimeter).	=No. 80 powder.
A *fine* powder	should pass through a sieve having 60 meshes to the linear inch (24 meshes to the centimeter).	=No. 60 powder.
A *moderately fine* powder	should pass through a sieve having 50 meshes to the linear inch (20 meshes to the centimeter).	=No. 50 powder.
A *moderately coarse* powder	should pass through a sieve having 40 meshes to the linear inch (16 meshes to the centimeter).	=No. 40 powder.
A *coarse* powder	should pass through a sieve having 20 meshes to the linear inch (8 meshes to the centimeter).	=No. 20 powder.

"In certain cases, powders of a different degree of fineness (*e.g.*, No. 30, No. 12) are directed to be taken.

"When a substance is directed to be in powder of a limited degree of fineness, as specified by the number of meshes to the linear inch in the sieve, not more than ¼ of the powder should pass through a sieve having 10 meshes more to the linear inch"—(*U. S. P.*).

PERCOLATION.—"The process of percolation, or displacement, directed in this Pharmacopœia, consists in subjecting a substance or a mixture of substances, in powder, contained in a vessel called a percolator, to the solvent action of successive portions of a certain menstruum in such a manner that the liquid, as it traverses the powder in its descent to the receiver, shall be charged with the soluble portion of it, and pass from the percolator free from insoluble matter.

"When the process is successfully conducted, the first portion of the liquid, or percolate, passing through the percolator, will be nearly saturated with the soluble constituents of the substance treated; and if the quantity of menstruum be sufficient for its exhaustion, the last portion of the percolate will be nearly free from color, odor, and taste, other than those of the menstruum itself.

"The percolator most suitable for the quantities contemplated by this Pharmacopœia should be nearly cylindrical, or slightly conical, with a funnel-shaped termination at the smaller end. The neck of this funnel-end should be rather short, and should gradually and regularly become narrower towards the orifice, so that a perforated cork, bearing a short glass tube, may be tightly wedged into it from within until the end of the cork is flush with the outer edge of the orifice. The glass tube, which must not project above the inner surface of the cork, should extend from 3 to 4 Cm. (about 1¼ to 1½ inches) beyond the outer surface of the cork, and should be provided with a closely-fitting rubber tube, at least one-fourth longer than the percolator itself, and ending in another short glass tube, whereby the rubber tube may be so suspended that its orifice shall be above the surface of the menstruum in the percolator, a rubber band holding it in position.

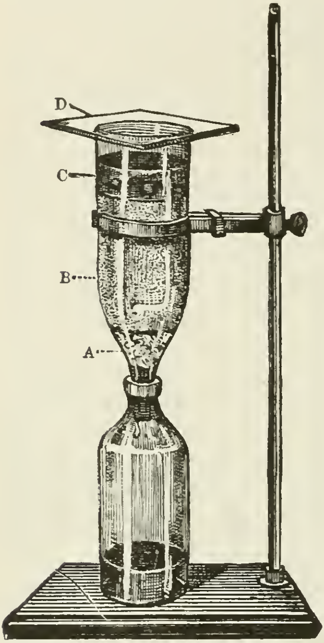
"The shape of a percolator should be adapted to the nature of the drug to be operated upon. For drugs which are apt to swell, particularly when a feebly alcoholic or an aqueous menstruum is employed, a *conical* percolator is preferable. A *cylindrical*, or only slightly tapering percolator may be used for drugs which are not liable to swell, and when the menstruum is strongly alcoholic, or when ether or some other volatile liquid is used for extraction. The size of the percolator selected should be in proportion to the quantity of drug extracted. When properly packed in the percolator, the drug should not occupy more than two-thirds of its height. The percolator is best constructed of glass or stoneware, but, unless otherwise directed, may be made of any suitable material not affected by the drug or menstruum.

"The percolator is prepared for percolation by gently pressing a small tuft of cotton into the neck above the cork, a thin layer of clean and dry sand being then poured upon the surface of the cotton to hold it in place.

"The powdered substance to be percolated (which must be uniformly of the fineness directed in the formula, and should be perfectly air-dry before it is weighed) is put into a basin, the specified quantity of menstruum is poured on, and it is thoroughly stirred with a spatula, or other suitable instrument, until it appears uniformly moistened. The moist powder is then passed through a coarse sieve—No. 40 powders, and those which are finer, requiring a No. 20 sieve, whilst No. 30 powders require a No. 15 sieve for this purpose. Powders of a less degree of fineness usually do not require this additional treatment after the moistening. The moist powder is now transferred to a sheet of thick paper and the whole quantity poured from this into the percolator. It is then shaken down lightly and allowed to remain in that condition for a period varying from 15 minutes to several hours, unless otherwise directed; after which the powder is pressed, by the aid of a plunger of suitable dimensions, more or less firmly, in proportion to the character of the powdered substance and the alcoholic strength of the menstruum; strongly alcoholic menstrua, as a rule, permitting firmer packing of the powder than the weaker. The percolator is now placed in position for percolation, and, the rubber tube having been fastened at a suitable height, the surface of the powder is covered by an accurately fitting disk of filtering paper, or other suitable material, and a sufficient quantity of the menstruum poured on through a funnel reaching nearly to the surface of the paper. If these conditions be accurately observed, the menstruum will penetrate the powder equally until it has passed into the rubber tube and has reached, in this, a height corresponding to its level in the percolator, which is now closely covered to prevent evaporation. The apparatus is then allowed to stand at rest for the time specified in the formula.

"To begin percolation, the rubber tube is lowered and its glass end introduced into the neck of a bottle previously marked for the quantity of liquid to be percolated, if the percolate is to be measured, or of a tared bottle, if the percolate is to be weighed; and by raising or lowering this receiver the rapidity of percolation may be increased or decreased as may be desirable, care being taken, however, that the rate of percolation, unless the quantity of material be largely in excess of the pharmacopœial quantity, shall not exceed the limit of 10 to 30 drops in a minute. A layer of menstruum must constantly be maintained above the powder, so as to prevent the access of air to its interstices, until all has been added, or the requisite quantity of percolate has been obtained. This is conveniently accomplished, if the space above the powder will admit of it, by inverting a bottle containing the entire quantity of menstruum over the percolator in such a manner that its mouth may dip beneath the surface of the liquid, the bottle, being of such shape that its shoulder will serve as a cover for the percolator.

112.



The percolator.

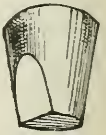
"When the dregs of a tincture, or of a similar preparation, are to be subjected to percolation, after maceration with all or with the greater portion of the menstruum, the liquid portion should be drained off as completely as possible, the solid portion packed in a percolator, as before described, and the liquid poured on, until all has passed from the surface, when immediately a sufficient quantity of the original menstruum should be poured on to displace the absorbed liquid, until the prescribed quantity has been obtained"—(*U. S. P.*).

Repercolation.—"Authority is given to employ, in the case of Fluid Extracts, where it may be applicable, the process of repercolation, without change of the initial menstruum"—(*U. S. P.*).

In addition to the foregoing, we will reproduce the following remarks from our 1881 supplement, wherein we consider in detail some points that may prove of use.

The Percolator should be of glass where moderate amounts of material are operated upon. Large quantities require tin or wood. In all cases they should be nearly cylindrical, slightly conical, and of such diameter that the powder would occupy at least 1 foot in perpendicular height when properly packed.

Fig. 113.



The cork.

To Prepare the Percolator for Percolation.—Provide a tapering cork which will perfectly close the exit or discharging aperture, so that when the percolate appears, the flow may be at once arrested. Then slice one side of the cork wedge-shape, commencing at the small end, as shown in Fig. 113, care being taken that the cut does not extend beyond that part of the cork which closes tightly the exit of the percolator. Now, place a layer of cotton upon the bottom of the percolator, as shown by Fig. 112, A; and, if convenient, a smooth layer of silver sand upon the cotton.

The 16 troy ounces of powder intended for percolation should, as soon as it is ready, be placed in the percolator, about one-fourth its bulk at a time; the surface should be smoothed after each addition, and then pressed as directed, for each drug. It is necessary that the pressure be even throughout the entire mass, otherwise the liquid will select the more porous portions, and thus yield a defective percolation.

It is best to select some flat circular body or disk to use in pressing the powder, and for this purpose a circular stick of wood with a smooth end, in thickness about two-thirds the diameter of the inside of the percolator, answers very well, care being taken that all portions of the surface of the powder are submitted alike to the pressure.

By *moderately*, we understand the pressure of from 5 to 10 pounds; *firmly*, from 15 to 20 pounds; and *very firmly*, the convenient pressure of one hand, not to exceed 50 pounds. Some little practice with a pair of spring balances will enable the operator to form an idea of the pressure required. Dr. E. R. Squibb, in *New Remedies*, Jan., 1879, suggests "moderately" as a pressure of 45 pounds; firmly, 60 pounds; and hard, 75 pounds, or more. This will answer very well for large quantities, or where the pressure is exerted upon a considerable surface, as with "both hands," thus, in reality, reducing the actual pressure upon each square inch to, or below, that given by us, which is intended to apply to only 16 troy ounces of material. We are assured, from experience, that the operator will work to disadvantage if a greater pressure is employed than advised by us. Having the powder properly packed, and the surface smooth, cut a piece of filtering paper to fit closely within the percolator, and place it upon the surface of the powder, and upon this place a few fragments of glass to retain it in position. Then add the menstruum, as directed, and cover the percolator with a plate or disk of ground glass, and, when the percolate appears, close the orifice tightly with the cork, and proceed according to the process given for making the particular extract. It must be observed that the cork is not inserted in the exit of the percolator until the *percolate* has appeared. When the period of maceration is over, gently twist and slowly withdraw the cork until the slit previously cut upon its side permits the liquid to pass in drops, without running in a stream.

Extracta.—EXTRACTS (*solid extracts*). When an infusion, decoction, or tincture is reduced to a soft, solid mass by evaporation, either spontaneous or artificial, it is termed an *Extract*. If it be prepared from a decoction or infusion it is called a *Watery*, or *Aqueous Extract;* if from an alcoholic tincture, it forms an *Alcoholic Extract;* if both water and spirit are used in preparing it, it is termed a *Hydro-alcoholic Extract;* if ether, wine, or acetic acid be the menstruum from which it is made, it is called *Ethereal*, *Vinous*, or *Acetous Extract*, according to the fluid used. The most important point in the manufacture of extracts is to employ as a solvent a liquid that will take up the medicinal constituents of a remedy, and but little, if any, of its inert portions. The constituents of plants not desirable to extract are gum, coloring matters, saccharine matter, etc., and as these are soluble in water, and are usually less soluble in alcohol, in most cases alcohol is a better medium for obtaining the active principles. The best solvent to abstract the medicinal virtues of plants will be that fluid in which they are the most readily dissolved: thus, resins, oils, oleoresins, etc., require alcohol, and, occasionally ether; alkaloidal principles occasionally require acidulated fluids; bitter extractive requires water; and some plants contain constituents that require two or more solvents, employed successively, the several residual extracts being mixed after they have all been thus obtained. In the preparation of an extract, the operator should previously acquaint himself with the nature of the principles contained in the drug, their solubility, their relations to heat and air, their volatility, etc., so that he may adopt the menstruum best calculated to remove the greatest amount of active matter, and should control the evaporation, so that this may not be injured by heat, or lost by volatilization.

Probably no class of remedial agents requires more care in their preparation; for, if an extract be improperly prepared, either by employing a wrong solvent, or too much heat, it is not to be relied upon by the physician. In many cases the extract must be evaporated *in vacuo*, which operates against the pharmacist, for he can not afford this expensive apparatus. On this account it is very difficult for druggists or physicians to compete in this direction with manufacturers.

In some cases glycerin is useful as a part of the menstruum, both as a solvent and to prevent subsequent drying of the extract. The *U. S. P.* contains the following directions for such preparations: "When it is desired to preserve a solid extract (for instance, of gentian, taraxacum, etc.) in a plastic condition, suitable for making pills, or for other purposes, it is recommended that there be incorporated with it, after it has been evaporated to the proper consistence, and while it is still warm, 10 per cent of its weight of glycerin"—(*U. S. P.*).

Ordinarily, the plan adopted is, to obtain the juice, or tincture, of the plant, gently heat it to coagulate albuminous substances, filter or strain it, and then evaporate at a temperature ranging between 32.2° and 93.3° C. (90° and 200° F.), being careful not to raise it to the boiling point. A high temperature, as well as atmospheric action, will impair the efficiency of the preparation.

In forming the solution for *aqueous extracts*, soft water, as free from foreign matters as possible, should be employed. Clean rain water, or the water from some of our lakes or rivers, will be found to answer quite as well as water which has been distilled. The articles to be acted upon by the fluid should be ground, but not too finely, the degree of fineness depending upon the substance used, and the resulting liquid should be obtained from them by the process of displacement. The evaporation should be conducted at as low a temperature, and as quickly as the nature of the solution will admit, using a broad, shallow dish. Long continued evaporation by heat, under exposure to the atmosphere, is as detrimental to an extract as a boiling heat, hence the solutions should be procured in as concentrated a form as possible. And in those instances where different solutions are obtained, the weaker ones should be the first evaporated; by this means, the more concentrated liquids will not be injured by too long an exposure to heat.

When alcohol or ether is used in the preparation of extracts, it will be best to distill these fluids, not only for the purpose of saving them, but likewise to prevent the extracts from being impaired by atmospheric influence; a vacuum apparatus, however, will be superior to ordinary distillation, as these fluids may be evaporated at a much lower temperature. *Hydro-alcoholic extracts* are best made by first forming an alcoholic extract from the plant, then an aqueous extract, and combining the two while hot. *Ethereal extracts* are usually of a semi-fluid consistence. By means of Mohr's continuous displacing apparatus, as the percolated tincture falls into the receiver, the ether is driven off to pass again through the articles, and thus continues until all their strength is exhausted; the whole process of tincturing and forming an extract being thus performed at the same time. Extracts should be kept in glass, stone, or earthenware vessels, and be guarded as much as possible from the action of air and light, by covering them closely. The modes of preparing extracts are as follows:

1. *Aqueous Extracts.*—Take of the leaves, root, bark, or other part of the plant employed, in powder more or less fine, 1 pound; water, a sufficient quantity. Mix the leaves, or roots, etc., with half their weight of clean, soft water; in 12 hours put the whole into a displacement apparatus, and exhaust it by adding water to it from time to time, until the liquid which passes no longer contains any of the virtues of the plant, or part of it employed. Expose this filtered infusion to a temperature of 100° C. (212° F.), then strain it, and evaporate it in the vapor-bath at a temperature not to exceed 48.8° C. (120° F.), to the due consistence; or, the evaporation may be conducted in a vacuum apparatus.

2. *Alcoholic Extracts.*—Take of the leaves, root, bark, or other part of the plant employed, in powder more or less fine, 1 pound; alcohol (or diluted alcohol), water, of each, a sufficient quantity. Mix the leaves, or root, etc., with half their weight of alcohol, or enough to thoroughly moisten them; in 24 hours put the whole into a displacement apparatus, and exhaust by adding alcohol to it from time to time, until 4 pints of tincture have been obtained. Then add clean, soft water, and continue until the liquid which percolates causes a slight turbidness of the previously filtered liquor, as it drops into it. (The object of adding the water toward the latter part of the process is to remove the alcohol absorbed by the powder; and as soon as this is affected, and the water commences to percolate, it causes a turbid condition of the filtered alcoholic fluid immediately around the drops as they fall into it.) Place the filtered liquor in a suitable vacuum apparatus, and remove the alcohol, and then, if necessary, evaporate the residue in the

vapor-bath at a temperature not to exceed 48.8° C. (120° F.) to the due consistence; or, which is much better, the whole process of evaporation may be carried on in a vacuum apparatus.

3. *Hydro-alcoholic Extracts.*—Take of the leaves, root, bark, or other part of the plant employed, in powder more or less fine, 1 pound; alcohol, 90 per cent, water, of each, a sufficient quantity. Mix the leaves, or roots, etc., with half their weight of alcohol, or enough to thoroughly moisten them; in 24 hours put the whole into a displacement apparatus, and exhaust by adding alcohol to it from time to time, until it passes off without any taste of the article employed. Remove the greater part of the alcohol from this filtered tincture, and evaporate the remainder to the proper consistence in one of the ways named in the preceding pages; that *in vacuo* being the best.

To the powder in the displacement apparatus, add gradually water, a *sufficient quantity*, until the liquid which passes no longer contains any of the virtues of the plant employed. Expose this filtered infusion to a temperature of 100° C. (212° F.), then strain it, and evaporate it in the vapor-bath to the due consistence. Mix the alcoholic and aqueous extracts thus obtained, while each is hot, and stir constantly until cold. With a few exceptions, alcoholic extracts are found to be superior to any others.

Any variation from the above process, in the preparation of the following extracts, will be explained under its appropriate head.

INSPISSATED JUICES are solid extracts made by evaporating the juices of fresh plants *in vacuo*. For an example see *Extract of Taraxacum*.

EXTRACTUM ACONITI (U. S. P.)—EXTRACT OF ACONITE.

SYNONYMS: *Extract of aconite root, Extractum aconiti radicis.*

Preparation.—"Aconite, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 oz., 120 grs.]; alcohol, a sufficient quantity. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol until three thousand cubic centimeters (3000 Cc.) [101 fl℥, 212 ♏] of tincture are obtained, or the aconite is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, evaporate the remainder in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏], add the reserved portion, and evaporate, at or below the above-mentioned temperature, until an extract of a pilular consistence remains"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—As this preparation and that formerly prepared from the leaves and still used to some extent, bear the same title, it would seem appropriate to designate this extract *Extractum Aconiti Radicis.* We have taken the liberty to name that from the leaves *Extractum Aconiti Foliorum* (see below). Extract of aconite has a yellowish-brown color, and possesses the properties of the root in a powerful degree; it may be used in *rheumatism, neuralgia, gout, scrofula, cutaneous diseases, inflammatory* and *febrile diseases*, and in all cases in which the use of aconite is admissible. When the extract is of good quality it causes numbness and tingling in the mouth and lips shortly after taking it. The extract prepared from the root is much more active (from 6 to 9 times stronger) than that prepared from the leaves, and should be administered in smaller doses, from $\frac{1}{10}$ to $\frac{1}{4}$ grain. The *British Pharmacopœia Extractum Aconiti* is the inspissated juice of the fresh leaves and tops, and is prescribed as *Extractum Aconiti Herbæ.*

EXTRACTUM ACONITI FOLIORUM, *Extract of aconite leaves.*—Exhaust coarsely powdered aconite leaves in a percolator with diluted alcohol, a sufficient quantity. From the tincture thus made separate the alcohol, and then carefully evaporate the residue until it is of the required consistence. Be careful not to spoil the extract by too high a temperature while evaporating it. The leaves should be recently dried. When the extract is prepared in large quantity a vacuum apparatus should be used in order to save the alcohol without exposure to a temperature that would injure the active medicinal virtues of the aconite (see preparation of *Alcoholic Extracts*). This extract of aconite is from 6 to 9 times weaker than the official extract of aconite, which is prepared from the root. As both the latter preparation and this one bear the same name, we have taken the liberty to designate that prepared from the leaves as *Extractum Aconiti Foliorum*. The dose is from $\frac{1}{4}$ to 1 grain 2 or 3 times a day, which may be increased to 2 grains if required.

EXTRACTUM ACONITI FLUIDUM (U. S. P.)—FLUID EXTRACT OF ACONITE.

SYNONYMS: *Extractum aconiti radicis fluidum, Fluid extract of aconite root.*

Preparation.—"Aconite, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and having moistened the powder with four hundred cubic centimeters (400 Cc.) [12 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder, and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the aconite is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder, in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to a soft extract, dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—Fluid extract of aconite has a vivid red-brown color, and represents in 1 minim about 1 grain of aconite root. It may be used in liniments and other local applications for the relief of *rheumatic* and *neuralgic pains*. For other uses, see *Aconitum*. The dose of fluid extract of aconite is from $\frac{1}{10}$ to $\frac{1}{2}$ minim.

EXTRACTUM ALETRIDIS.—EXTRACT OF ALETRIS.

SYNONYMS: *Aletridin, Aletrin, Extract of unicorn root.*

Preparation.—Exhaust coarsely powdered unicorn root with alcohol, proceeding in the same manner as explained for general preparation of alcoholic extracts.

Medical Uses and Dosage.—This forms a very elegant and useful preparation of unicorn root. It may be used as a tonic in cases of *debility* of the digestive organs, and is also asserted valuable in *uterine difficulties*, as *prolapsus*, *amenorrhœa*, *dysmenorrhœa*, etc. The dose is from $\frac{1}{2}$ to 2 grains, 3 times a day.

EXTRACTUM ALETRIDIS FLUIDUM (N. F.)—FLUID EXTRACT OF ALETRIS.

Preparation.—*Formulary number*, 137: "From the rhizome of *Aletris farinosa*, Linné (*Stargrass*). *Process A* (see F. 135). No. 60 powder. *Menstruum:* Diluted alcohol"—(*Nat. Form.*).

In our opinion this fluid extract should be made with official alcohol. Aletris depends altogether for its therapeutical value on resinous bodies. It is a favorite Eclectic remedy and usage establishes that water added to the menstruum injures the product about in proportion to the water present.

Medical Uses and Dosage.—(See *Aletris*). Dose, 1 to 60 minims.

EXTRACTUM ALOES (U. S. P.)—EXTRACT OF ALOES.

SYNONYMS: *Extractum aloes socotrinæ, Extract of socotrine aloes.*

Preparation.—"Socotrine aloes, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; boiling distilled water, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the aloes with the water in a suitable vessel, stirring constantly until the particles of aloes are thoroughly disintegrated, and let the mixture stand for 12 hours; then pour off the clear liquor, strain the residue, mix the liquids, and evaporate to dryness by means of a water or steam bath"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—The process here employed is one of purification. The object sought in the large quantity of water used is the removal of the resin, which is not, however, wholly accomplished. Therefore the finished product does not dissolve perfectly clear in water. This results partly from organic decomposition, partly from the fact that an equilibrium is not established in 12 hours, and partly because a solution of water-soluble constituents makes a solvent that can hold in solution substances insoluble in pure water. The uses are those of aloes, and the dose from 1 to 10 grains.

EXTRACTUM ALSTONIÆ CONSTRICTÆ FLUIDUM.—FLUID EXTRACT OF ALSTONIA CONSTRICTA.

Preparation.—Take of the inner bark of Alstonia constricta, in very fine powder, 16 troy ounces; alcohol, a sufficient quantity. Moisten the powder with 8 fluid ounces of alcohol. Cork tightly in a wide-mouth bottle, and permit the mixture to stand an hour in a warm situation. Then introduce it into a cylindrical percolator, 3 inches in diameter, previously prepared for percolation, according to directions given on page 756, and press very firmly. Cover the surface of the powder with a circular piece of filtering paper, held in position with a few fragments of glass or marble, and add alcohol until the percolate appears at the exit. Then cork the exit tightly; cover the percolator, and place it in a warm situation. After 24 hours, loosen the cork, and permit the percolate to pass as fast as it will drop, without running in a stream, until 4 fluid ounces are obtained. Again close the exit, macerate 24 hours, and, in a manner like unto the preceding, draw 4 fluid ounces of percolate. Repeat the maceration, and, in like manner, draw a third portion of 4 fluid ounces. Reserve, and mix the three percolates; then continue the percolation until 8 fluid ounces are obtained. Evaporate this latter portion until reduced to the measure of 2 fluid ounces, and mix with the reserved 12 fluid ounces. The surface of the powder must be constantly covered with alcohol from the commencement, and until the end of the percolation.

Description, Medical Uses, and Dosage.—(See *Alstonia constricta*). Fluid extract of Alstonia constricta is of a dark yellowish-red color, odorless, and possesses the intense bitterness peculiar to the drug. When prepared according to the foregoing formula, it seems to represent very nearly the entire sensible properties of the bark employed, troy ounce to each fluid ounce of the finished extract. Dose, from 5 to 40 minims.

EXTRACTUM ALSTONIÆ SCHOLARIS FLUIDUM.—FLUID EXTRACT OF ALSTONIA SCHOLARIS.

Preparation.—Take of the bark of Alstonia scholaris, in moderately fine powder, 16 troy ounces; of a menstruum of alcohol 3 parts, water 2 parts (by measure), a sufficient quantity; moisten the powder with 8 fluid ounces of the menstruum. Cork tightly in a wide-mouth bottle, and permit the mixture to stand an hour in a warm situation. Then introduce it into a cylindrical percolator, 3 inches in diameter, previously prepared for percolation, according to directions given on page 756, and press very firmly. Cover the surface of the powder with a circular piece of filtering paper held in position with a few fragments of glass or marble, and add fresh menstruum until the percolate appears at the exit. Then cork the exit tightly; cover the percolator and place in a warm situation. After 24 hours, loosen the cork and permit the percolate to pass as fast as it will drop, without running in a stream, until 4 fluid ounces are obtained. Again close the exit, macerate 24 hours, and, in a manner like unto the preceding, draw 4 fluid ounces of percolate. Repeat the maceration, and, in like manner, draw a third portion of 4 fluid ounces. Reserve, and mix the three percolates; then continue the percolation until 8 fluid ounces are obtained. Evaporate this latter portion until reduced to the measure of 2 fluid ounces, and mix with the reserved 12 fluid ounces. The surface of the powder must be constantly covered with the menstruum from the commencement, and until the end of the process of percolation.

Description, Medical Uses, and Dosage.—(See *Alstonia scholaris*). Fluid extract of Alstonia scholaris is of a reddish color, odorless, possesses a bitterish taste, and as thus prepared, represents very nearly the quality of drug employed, troy ounce to each fluid ounce of the finished extract. Dose, 10 to 60 minims.

EXTRACTUM ANGELICÆ RADICIS FLUIDUM (N. F.)—FLUID EXTRACT OF ANGELICA ROOT.

Preparation.—*Formulary number*, 138: "From the root of *Angelica Archangelica*, Linné (*Angelica*). *Process A* (see F. 135). No. 60 powder. *Menstruum:* Alcohol, 3 volumes; water, 2 volumes"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Angelica*). Dose, 10 to 60 minims.

EXTRACTUM ANTHEMIDIS.—EXTRACT OF CHAMOMILE.

Preparation.—"Take of chamomile flowers 1 pound (av.), oil of chamomile 15 minims, distilled water 1 gallon. Boil the chamomile with the water until the volume is reduced to one-half; then strain, press, and filter. Evaporate the liquor by a water-bath until the extract is of a suitable consistence for forming pills, adding the oil of chamomile at the end of the process (*Br. Pharm.*). This is an aqueous extract of deep-brown color, representing the odor and bitter taste of the flowers. An alcoholic extract may be prepared as follows:

EXTRACTUM ANTHEMIDIS ALCOHOLICUM, *Alcoholic extract of chamomile.*—Exhaust chamomile flowers, bruised, 1 pound, with diluted alcohol a sufficient quantity, proceeding in the same manner as explained for the preparation of *Alcoholic Extracts*, on page 758. At the close of the process volatile oil of chamomile, 15 minims, may be thoroughly incorporated with the extract, as advised by the *British Pharmacopœia.*

Medical Uses and Dosage.—Extract of chamomile is a tonic, and may be used in all cases where the crude article is indicated. It may be beneficially combined with other extracts, as of scullcap, cramp-bark, black cohosh, golden-seal, ladies'-slipper, etc. The dose of the alcoholic extract is from 1 to 5 grains 3 times a day; of the aqueous extract, 1 to 10 grains.

EXTRACTUM ANTHEMIDIS FLUIDUM.—FLUID EXTRACT OF CHAMOMILE.

Preparation.—Take of chamomile flowers in powder 16 troy ounces, of a mixture of alcohol 3 parts, water 2 parts, a sufficient quantity. Moisten; proceed according to formula of fluid extract of Alstonia scholaris ending with the word *percolation.*

Medical Uses and Dosage.—This fluid extract of chamomile flowers is a tonic, and possesses all the properties of the crude article. Each fluid ounce of the extract represents a fluid ounce of the flowers; hence the dose is from 1 to 60 drops, 3 times a day. It may be advantageously combined with the fluid extracts of cimicifuga, valerian, cypripedium, scutellaria, etc.

EXTRACTUM APII GRAVEOLENTIS FLUIDUM (N. F.)—FLUID EXTRACT OF CELERY.

Preparation.—*Formulary number*, 139: "From the seed of *Apium graveolens*, Linné (*Celery*). *Process A* (see F. 135). No. 60 powder. *Menstruum:* Alcohol, 2 volumes; water, 1 volume"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Apium graveolens*). Dose, 10 to 30 minims.

EXTRACTUM APOCYNI.—EXTRACT OF BITTER ROOT.

SYNONYM: *Extract of Indian hemp.*

Preparation.—Exhaust coarsely powdered Indian hemp (*Apocynum cannabinum*), 1 pound, with alcohol, water, of each, a sufficient quantity, proceeding in the same manner as explained for the preparation of Alcoholic Extracts, on page 758, This extract, either dried or not, has been sold and employed in therapeutics under the erroneous name of *apocynin*.

Medical Uses and Dosage.—This extract is purgative, and either alone or in combination with extract of leptandra, has been employed in *affections of the liver* and *stomach*, in *intermittents*, and formerly in the *low stage of typhoid fevers*. It has also been employed with advantage as a diuretic and emmenagogue. The dose is from 1 to 10 grains, 2 or 3 times a day.

EXTRACTUM APOCYNI FLUIDUM (U. S. P.)—FLUID EXTRACT OF APOCYNUM.

SYNONYM: *Fluid extract of Canadian hemp.*

Preparation.—"Apocynum, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of alcohol and two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward a mixture of alcohol and water, made in the proportion of six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of alcohol to three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of water until the apocynum is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). In our opinion the glycerin has no value in this preparation, being inferior to alcohol. A better menstruum is a mixture of alcohol 3 parts, water 1 part.

Medical Uses and Dosage.—(See *Apocynum*). Dose, 1 to 20 minims.

EXTRACTUM ARALIÆ RACEMOSÆ FLUIDUM (N. F.)—FLUID EXTRACT OF ARALIA RACEMOSA.

Preparation.—*Formulary number*, 140: "From the root of *Aralia racemosa*, Linné (*American spikenard*). *Process A* (see F. 135). No. 60 powder. *Menstruum:* Alcohol, 2 volumes; water, 1 volume"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Aralia racemosa*). Dose, 10 to 60 minims.

EXTRACTUM ARNICÆ RADICIS (U. S. P.)—EXTRACT OF ARNICA ROOT.

Preparation.—"Arnica root, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lb. av., 3 oz., 120 grs.]; diluted alcohol, a sufficient quantity. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 24 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the arnica root is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate; evaporate the remainder to one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏], at a temperature not exceeding 50° C. (122° F.), mix the residue with the reserved portion, and evaporate, at or below the above mentioned temperature, to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Arnica*). A brown extract of feeble odor and a bitter, acrid taste. Used chiefly in plasters. Dose, 3 to 5 grains.

EXTRACTUM ARNICÆ RADICIS FLUIDUM (U. S. P.)—FLUID EXTRACT OF ARNICA ROOT.

Preparation.—"Arnica root, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lb. av., 3 oz., 120 grs.]; alcohol, water, each, a sufficient quantity, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder, and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportion of alcohol and water as before, until the arnica root is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Arnica*). A reddish-brown fluid possessing the bitter, acrid taste of arnica root. Dose, 10 to 30 minims.

Related Preparation.—EXTRACTUM ARNICÆ FLORUM FLUIDUM (N. F.), *Fluid extract of arnica flowers. Formulary number*, 141: "From the flower heads of *Arnica montana*, Linné (*Arnica*). *Process* A (see F. 135). No. 40 powder. *Menstruum:* Diluted alcohol"—(*Nat. Form.*).

EXTRACTUM AROMATICUM.—AROMATIC EXTRACT.

Preparation.—Take of cinnamon, ginger, each, in fine powder, 3 troy ounces; cardamom, free from capsules, nutmeg, each, in fine powder, 1½ troy ounces; sugar, 9 troy ounces; alcohol of sp. gr. 0.817, a sufficient quantity. Mix all the powdered aromatics, put the mixture in a percolator, and gradually add alcohol until the mixture is exhausted; pour the resulting percolate over the sugar, evaporate at a low heat until dry, agitating constantly toward the end of the process.

Medical Uses and Dosage.—This forms a pleasant stimulant and carminative, which may be used in cases of *flatulency*, in *gastric debility*, and to render other medicines more palatable. It answers all the purposes of the "*Aromatic powder*," now official, and "*Aromatic confection*," formerly official in the *U. S. P.* The dose is from 5 to 60 grains. Added to wine it forms a very good *Aromatic wine*.

EXTRACTUM AROMATICUM FLUIDUM (U. S. P.)—AROMATIC FLUID EXTRACT.

Preparation.—Aromatic powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol until the aromatic powder is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏].

Description, Medical Uses, and Dosage.—A rich, red-brown fluid, possessing a warm taste and aromatic flavor. Used for flavoring, and, in doses of ½ to 1 fluid drachm, as a carminative.

EXTRACTUM ASCLEPIADIS.—EXTRACT OF ASCLEPIAS.

Synonym: *Extract of pleurisy root.*

Preparation.—Exhaust coarsely powdered pleurisy root, 1 pound, with alcohol, water, of each, a sufficient quantity, proceeding in the manner as explained for the preparation of Alcoholic Extracts on page 758 (J. King).

Medical Uses and Dosage.—Alcoholic extract of pleurisy root is expectorant, tonic, laxative, and antispasmodic. It will be found useful in chronic and acute *catarrhal coughs*, *rheumatic affections*, *dysentery*, etc. From its peculiar action upon the ligaments of the uterus, it proves highly beneficial in *prolapsus*, and other *displacements* of this organ. The dose is from 3 to 10 or 15 grains, 3 times a day.

EXTRACTUM ASCLEPIADIS FLUIDUM (U. S. P.)—FLUID EXTRACT OF ASCLEPIAS.

Synonym: *Fluid extract of pleurisy root.*

Preparation.—"Asclepias, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the asclepias is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Asclepias.*) A brown-red fluid. Dose, 5 to 60 minims.

EXTRACTUM ASPIDOSPERMATIS FLUIDUM (U. S. P.)—FLUID EXTRACT OF ASPIDOSPERMA.

Synonym: *Fluid extract of quebracho.*

Preparation.—"Aspidosperma, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol and three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then a mixture of alcohol and water, made in the proportion of two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of alcohol to one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of water, until the aspidosperma is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder at a temperature not exceeding 50° C. (122° F.) to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏) "—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Aspidosperma*). Dose, 15 to 60 minims.

EXTRACTUM AURANTII AMARI FLUIDUM (U. S. P.)—FLUID EXTRACT OF BITTER ORANGE PEEL.

Preparation.—"Bitter orange peel, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, and, having moistened the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of the mixture, pack it moderately in a conical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the orange peel is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—When properly prepared from good orange peel this fluid has a yellowish-brown hue, and possesses the pleasant flavor and agreeable bitterness of the crude drug. Used chiefly as a flavoring agent. Dose, 1 fluid drachm.

EXTRACTUM BAPTISIÆ.—EXTRACT OF BAPTISIA.

SYNONYM: *Extract of wild indigo.*

Preparation.—Exhaust coarsely powdered bark of wild indigo root, 1 pound, with alcohol, water, each, a sufficient quantity, proceeding in the same manner as explained for the preparation of Alcoholic Extracts.

Medical Uses and Dosage.—This extract is antiseptic, with purgative and emetic properties when taken in large doses. It is especially advantageous in *typhoid conditions* of the system, in *malignant ulcerations of the mouth* and *throat*, in *scarlatina*, and in all cases where there is a tendency to *putrescency* or *gangrene*. It exerts a powerful stimulant effect on the glandular and nervous systems, and will be found useful in *scrofula*, *obstinate hepatic torpor*, etc. Its virtues are increased by combination with extract of leptandra, resin of podophyllum or cimcifuga. The dose is ¼ grain, gradually increased to 1 or 2 grains, and repeated 3 times a day (J. King).

EXTRACTUM BELLADONNÆ FOLIORUM ALCOHOLICUM (U. S. P.) ALCOHOLIC EXTRACT OF BELLADONNA LEAVES.

SYNONYM: *Extractum belladonnæ alcoholicum* (*Pharm.*, 1880).

Preparation.—"Belladonna leaves, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity. Mix two thousand cubic centimeters (2000 Cc.) [67 fl℥, 301 ♏] of alcohol with one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥

252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until three thousand cubic centimeters (3000 Cc.) [101 fl℥, 212 ♏] of tincture are obtained, or the belladonna leaves are exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, evaporate the remainder at a temperate not exceeding 50° C. (122° F), to one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏], mix the residue with the reserved portion, and evaporate at or below the above-mentioned temperature to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This extract possesses the odor and taste of belladonna, and is greenish-brown or brownish-green in color. It is used chiefly, locally, to allay *pain* and to control *spasm*. Its internal use is the same as for belladonna. The dose ranges from $\frac{1}{6}$ to $\frac{1}{3}$ grain, 3 times a day.

EXTRACTUM BELLADONNÆ RADICIS FLUIDUM (U. S. P.)—FLUID EXTRACT OF BELLADONNA ROOT.

SYNONYM: *Extractum belladonnæ fluidum* (*Pharm.*, 1880).

Preparation.—"Belladonna root, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]: alcohol, water, each a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of alcohol with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of water, and, having moistened the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the belladonna root is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage. (See *Belladonna*.) Fluid extract of belladonna root has a reddish-brown color. The dose ranges from $\frac{1}{2}$ to 2 minims.

EXTRACTUM BERBERIDIS AQUIFOLII FLUIDUM.—FLUID EXTRACT OF BERBERIS AQUIFOLIUM.

Preparation.—Take of the root of Berberis aquifolium, in moderately fine powder, 16 troy ounces; of a menstruum of alcohol, 3 parts, water, 2 parts (by measure), a sufficient quantity. Moisten the powder with 6 fluid ounces of the menstruum. Cork tightly in a wide-mouthed bottle, and permit the mixture to stand an hour in a warm situation. Then introduce into a cylindrical percolator, 3 inches in diameter, previously prepared for percolation, according to directions given on page 756, and press moderately. Cover the surface of the powder with a circular piece of filtering paper, held in position with a few fragments of glass or marble, and add fresh menstruum until the percolate appears at the exit. Then cork the exit tightly; cover the percolator, and place it in a warm situation. After 24 hours, loosen the cork, and permit the percolate to pass as fast as it will drop, without running in a stream, until 4 fluid ounces are obtained. Again close the exit, macerate 24 hours, and, in a manner like unto the preceding, draw 4 fluid ounces of percolate. Repeat the maceration, and, in like manner, draw a third portion of 4 fluid ounces. Reserve and mix the 3 percolates;

then continue the percolation until 8 fluid ounces are obtained. Evaporate this latter portion until reduced to the measure of 2 fluid ounces, and mix with the reserved 12 fluid ounces. The surface of the powder must be constantly covered with the menstruum from the commencement, and until the end of the process of percolation.

Description, Medical Uses, and Dosage.—(See *Berberis aquifolium*). Fluid extract of Berberis aquifolium is of a yellowish-red color, odorless, or nearly so, and very bitter to the taste, and, as thus prepared, represents very nearly the quality of the drug employed, troy ounce to each fluid ounce of the finished extract. Dose, 5 to 20 drops.

EXTRACTUM BERBERIDIS VULGARIS FLUIDUM (N. F.)—FLUID EXTRACT OF BERBERIS VULGARIS.

Preparation.—*Formulary number*, 142: "From the bark of the root of *Berberis vulgaris*, Linné (*Barberry*). *Process A* (see F. 135). No. 60 powder. *Menstruum:* Alcohol, 3 volumes; water, 2 volumes"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Berberis vulgaris*). Dose, 5 to 30 minims.

EXTRACTUM BOLDO FLUIDUM.—FLUID EXTRACT OF BOLDO.

SYNONYM: *Fluid extract of Peumus boldo.*

Preparation.—Take of boldo leaves, in very fine powder, 16 troy ounces; alcohol, a sufficient quantity. Moisten the boldo with 6 fluid ounces of alcohol. Cork tightly in a wide-mouth bottle, and permit the mixture to stand an hour in a warm situation. Then introduce it into a cylindrical percolator, 3 inches in diameter, previously prepared for percolation, according to directions given on page 756, and press very firmly. Cover the surface of the powder with a circular piece of filtering paper, held in position with a few fragments of glass or marble, and add alcohol until the percolate appears at the exit. Then cork the exit tightly; cover the percolator, and place it in a warm situation. After 24 hours, loosen the cork, and permit the percolate to pass as fast as it will drop, without running in a stream, until 4 fluid ounces are obtained. Again close the exit, macerate 24 hours, and in a manner like unto the preceding, draw 4 fluid ounces of percolate. Repeat the maceration, and, in like manner, draw a third portion of 4 fluid ounces. Reserve, and mix the three percolates; then continue the percolation until 8 fluid ounces are obtained. Evaporate this latter portion until reduced to the measure of 2 fluid ounces, and mix with the reserved 12 fluid ounces. The surface of the powder must be constantly covered with alcohol from the commencement, and until the end of the process of percolation.

Description, Medical Uses, and Dosage.—(See *Boldo*). Fluid extract of boldo is dark-green in color, of a disagreeable wormseed-like odor and taste, and as thus prepared, represents very nearly the quality of drug employed, troy ounce for each fluid ounce of the finished extract. Dose, 5 to 20 minims.

EXTRACTUM BRYONIÆ FLUIDUM.—FLUID EXTRACT OF BRYONIA.

Preparation.—Take of bryonia root, in moderately fine powder, 16 troy ounces; alcohol and water, each, a sufficient quantity. Moisten the bryonia with 3 fluid ounces of water, and permit the mixture to stand 1 hour in a well-corked wide-mouth bottle. Then intimately rub it with 6 fluid ounces of alcohol, and allow the mixture to macerate an hour as before. Introduce this, with moderate pressure, into a cylindrical percolator, 3 inches in diameter, that has been previously prepared for percolation, according to directions given on page 756. Cover the surface of the powder with a circular piece of filtering paper, held in position with a few fragments of glass or marble, and add a mixture of alcohol, by measure, 2 parts, until the percolate appears at the exit. Then cork the exit tightly; cover the percolator, and place it in a warm situation. After 24 hours, loosen the cork, and permit the percolate to pass as fast as it will drop, without running in a stream, until 4 fluid ounces are obtained. Again close the exit, macerate 24 hours, and, in a manner like unto the preceding, draw 4 fluid ounces of percolate. Repeat the maceration, and, in like manner, draw a third portion of 4 fluid ounces. Reserve, and mix the three percolates; then continue the percolation until 8 fluid ounces are obtained. Evaporate this latter until reduced to the measure of 2 fluid ounces, and mix with the reserved 12 fluid ounces. The surface of the powder must be constantly covered with menstruum from the commencement, and until the end of the process of percolation.

Description, Medical Uses, and Dosage.—Fluid extract of bryonia is dark red in color, and, as thus prepared, represents very nearly the quality of the drug employed, troy ounce to each fluid ounce of the finished extract. The preliminary use of water in moistening this drug brings it to a condition which favors the ready permeation of the menstruum. (For uses, see *Bryonia*). Dose, 1 to 2 drops.

EXTRACTUM BUCHU FLUIDUM (U. S. P.)—FLUID EXTRACT OF BUCHU.

Preparation.—"Buchu, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol, until the buchu is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—Fluid extract of buchu has a clear, deep-green color, and the taste and odor of buchu leaves. It is a gently stimulating diuretic, and may be used in *chronic catarrh of the bladder*, *gravel*, *morbid irritation of the bladder* and *urethra*, and other affections of the urinary organs. The dose is from 20 to 60 minims 3 times a day.

Related Preparation.—EXTRACTUM BUCHU FLUIDUM COMPOSITUM (N. F.), *Compound fluid extract of buchu. Formulary number*, 144: "Buchu, six hundred and twenty-five grammes (625 Gm.) [1 lb. av., 6 ozs., 20 grs.]; cubeb, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; juniper, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; uva ursi, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]. *Process A* (see F. 135). No. 40 powder. *Menstruum:* Alcohol, 2 volumes; water, 1 volume"—(*Nat. Form.*).

EXTRACTUM CALAMI FLUIDUM (U. S. P.)—FLUID EXTRACT OF CALAMUS.

Preparation.—"Calamus, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lb. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol until the calamus is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏) of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏)"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This preparation has the characteristic taste and odor of calamus. If made from peeled calamus, it is of a brown-yellow color; if from unpeeled root, it has a deeper hue. Uses same as calamus. Dose, 5 to 20 minims.

EXTRACTUM CALENDULÆ FLUIDUM (N. F.)—FLUID EXTRACT OF CALENDULA.

Preparation.—*Formulary number*, 145: "From the flowering herb of *Calendula officinalis*, Linné (*Marigold*). *Process A* (see F. 135). No. 40 powder. *Menstruum:* Alcohol, 2 volumes; water, 1 volume"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Calendula*). Dose, 2 to 20 minims.

EXTRACTUM CALUMBÆ.—EXTRACT OF CALUMBA.

Synonym: *Extractum columbo.*

Preparation.—"Take of calumba root, cut small, 1 pound (av.); proof spirit, 4 pints (Imp.). Macerate the calumba with 2 pints of the proof spirit for 12 hours, strain and press. Macerate again with the same quantity of proof spirit, strain and press as before. Mix and filter the liquors, recover the spirit by distillation, and evaporate the residue by the heat of a water-bath until the extract is of a suitable consistence for forming pills" (*Br. Pharm.*).

Medical Uses and Dosage.—(See *Calumba*). Dose, 2 to 10 grains.

EXTRACTUM CALUMBÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF CALUMBA.

Preparation.—"Calumba, in No. 20 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and, having moistened the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the calumba is exhausted. Reserve the first seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏] of the percolate. Distill off the alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract, dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Calumba*). An intensely bitter, deep or orange-brown fluid. Dose, 10 to 30 minims.

EXTRACTUM CAMELLIÆ FLUIDUM (N. F.)—FLUID EXTRACT OF CAMELLIA.

Preparation.—*Formulary number*, 146: "From the commercial dried leaves of *Camellia Thea*, Link (*Tea*). *Process B* (see F. 135). No. 40 powder. *Menstruum I:* Alcohol, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; water, six hundred and eighty-five cubic centimeters (685 Cc.) [23 fl℥, 78 ♏]; glycerin, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]. *Menstruum II:* Alcohol, 1 volume; water, 3 volumes. *Note.*—It is recommended that the best quality of commercial black tea, preferably "Formosa Oolong," be employed for this preparation"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Thea*) Dose, 5 to 60 minims.

EXTRACTUM CANNABIS INDICÆ (U. S. P.)—EXTRACT OF INDIAN CANNABIS.

SYNONYM: *Extract of Indian hemp.*

Preparation.—"Indian cannabis, in No. 20 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity. Moisten the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol, until the cannabis is exhausted. Distill off the alcohol from the tincture by means of a water-bath, and evaporate the residue in a porcelain capsule, on a water-bath, to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This forms a dark, dull-green extract, having the well-marked odor of hemp resin, is soluble in strong alcohol, ether, chloroform, olive oil, and oil of turpentine, the latter solution depositing minute, scaly crystals on standing; almost wholly soluble in benzol; not affected by alkalies; and with cold nitric acid, sp. gr. 1.38, it is slowly acted on, evolving red fumes, being converted into an orange-red resinoid substance, about as abundant as the resin treated, and which, when washed with water and dried, resemble minute fragments of gamboge (W. Procter, Jr., *Proc. Amer. Pharm. Assoc.*, 1864, pp. 246–7). Much of the drug, cannabis indica, is moldy, partly decayed, and unfit for use. As a rule, this extract of cannabis is dull in color, and inferior to the extract purified according to the following method, which yields a deep-green, alcohol-soluble preparation. Uses, those of cannabis. Dose, ¼ grain, increased gradually until its effects are produced. On account of the variability of the preparation, the dose is not definitely established.

Related Preparation.—The following is Prof. Procter's method of preparing *Purified extract of Indian hemp:* EXTRACTUM CANNABIS PURIFICATUM, *Extract of Indian hemp, purified.*—Take of the green extract of Indian hemp, imported from India, 1½ troy ounces; triturate it thoroughly with alcohol, sp. gr. 0.820, 1½ fluid ounces; and then add to it of the same alcohol, 9 fluid ounces. Let the whole macerate for 36 hours, filter, and, while on the filter, add more alcohol until the extract is thoroughly exhausted. Evaporate the filtrate to dryness in a water-bath, at a temperature not exceeding 65.5° C. (150° F.). The uses are the same as stated under Cannabis. This extract, being purified, and possessing greater uniformity of strength than the ordinary commercial extract, should be administered in somewhat smaller doses. For making chlorodyne, this preparation is to be preferred to the extract made of the herb by the preceding process.

EXTRACTUM CANNABIS INDICÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF INDIAN CANNABIS.

SYNONYM: *Fluid extract of Indian hemp.*

Preparation.—"Indian cannabis, in No. 20 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol until the Indian cannabis is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate. Distill off the alcohol from the remainder by means of a water-bath, and evaporate the residue, in a porcelain capsule, to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Cannabis*). A deep-green fluid. Dose, ½ to 10 minims. In our opinion, a fluid extract made by dissolving a given amount of the purified extract of the preceding formula in official alcohol, is to be preferred to the foregoing.

EXTRACTUM CAPSICI FLUIDUM (U. S. P.)—FLUID EXTRACT OF CAPSICUM.

SYNONYM: *Fluid extract of red pepper.*

Preparation.—"Capsicum, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol, until the capsicum is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This is a rich, brownish-red fluid possessing the characteristic properties of capsicum. It is likely to deposit a red-brown, flocculent sediment by age, which, however, seems not to impair its value. Dose, ½ to 2 minims.

EXTRACTUM CASCARÆ SAGRADÆ.—EXTRACT OF CASCARA SAGRADA.

SYNONYM: *Extractum rhamni purshianæ.*

Preparation.—"Take of Cascara sagrada, in No. 40 powder, 1 pound (av.), proof spirit, distilled water, of each, a sufficiency. Mix the cascara with 2 pints of the spirit, and macerate in a closed vessel for 48 hours; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with water until 3 pints of liquid have been collected, or the cascara is exhausted. Evaporate the percolated liquid by a water-bath until the extract has acquired a suitable consistence"—(*Br. Pharm.*).

Medical Uses and Dosage.—(See *Rhamnus Purshiana.*) A good extract for use in pills. Dose, 2 to 8 grains.

EXTRACTUM CAULOPHYLLI.—EXTRACT OF CAULOPHYLLUM.

SYNONYM: *Extract of blue cohosh.*

Preparation.—Exhaust coarsely powdered blue cohosh root, 16 troy ounces, with alcohol, water, of each, a sufficient quantity, proceeding in the same manner as explained for the preparation of Alcoholic Extracts (see *Resin of Blue Cohosh*).

Medical Uses and Dosage.—Alcoholic extract of blue cohosh is antispasmodic and parturient. It may be advantageously combined with extract of dioscorea, in *bilious colic*, *flatulency*, and *griping pains* arising from the use of drastic purgatives; with oleoresin of prickly ash bark, alcoholic extracts of cimicifuga or scutellaria, in *rheumatic affections;* and with oleoresin of senecio, resin of cimicifuga, alcoholic extracts of aletris, asclepias, or high cranberry bark, in *uterine diseases.* It will be found very useful in *amenorrhœa* and *dysmenorrhœa;* and forms with hydrochlorate of berberine an elegant remedy for *deranged conditions of the stomach*, *dyspepsia*, etc. It has also been found serviceable in *after-pains.* The dose is from 1 to 5 grains, 3 times a day (J. King).

EXTRACTUM CAULOPHYLLI FLUIDUM (N. F.)—FLUID EXTRACT OF CAULOPHYLLUM.

Preparation.—*Formulary number*, 147: "From the rhizome and rootlets of *Caulophyllum thalictroides*, Michaux (*Blue cohosh*). *Process A* (see F. 135). No. 60 powder. *Menstruum:* Alcohol, 3 volumes; water, 1 volume"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Caulophyllum*). Dose, 5 to 30 minims.

EXTRACTUM CELASTRI FLUIDUM.—FLUID EXTRACT OF CELASTRUS.

SYNONYM: *Fluid extract of false bittersweet.*

Preparation.—Take of the recently dried bark of the root of false bittersweet, in fine powder, 16 troy ounces; diluted alcohol, a sufficient quantity. Moisten the powdered bark thoroughly with part of the diluted alcohol, and let it stand for 24 hours; then transfer it to a percolator, and gradually add diluted alcohol until 12 fluid ounces have been obtained. Set this aside; then add diluted alcohol until the bark is exhausted; evaporate this to 4 fluid ounces, and add it to the 12 fluid ounces first obtained, so as to make a pint of fluid extract.

Medical Uses and Dosage.—This fluid extract possesses the same virtues as the bark (see *Celastrus*), in doses of from ½ fluid drachm to 1 fluid drachm, 3 times a day.

EXTRACTUM CHIMAPHILÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF CHIMAPHILA.

Preparation.—"Chimaphila, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol until the chimaphila is exhausted. Reserve the first seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] '—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Chimaphila*). A deep, brownish-green fluid of a somewhat thick consistence. It is inferior to the infusion as a remedy. Dose, 60 minims, well diluted, 3 or 4 times a day.

EXTRACTUM CHIRATÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF CHIRATA.

Preparation.—"Chirata, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏) of alcohol with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, and, having moistened the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the chirata is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate. Distill off the alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This is a reddish-brown, intensely bitter fluid. Water fully extracts the virtues of chirata, but, as decomposition takes place by age, this is sought to be avoided by the addition of alcohol, which does not, however, wholly prevent subsequent deposition. This preparation is so little used as to make it a cumberer of the Pharmacopœia. Uses, those of chirata. Dose, 10 to 30 minims.

EXTRACTUM CIMICIFUGÆ (U. S. P.)—EXTRACT OF CIMICIFUGA.

SYNONYM: *Extract of black cohosh.*

Preparation.—"Cimicifuga, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity. Moisten the powder with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol, until the cimicifuga is exhausted. Distill off the alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—Extract of black cohosh is almost black in color, and is representative of the crude drug. It is suggested that a menstruum containing $\frac{1}{5}$ part water, will furnish as reliable a preparation. Extract of black cohosh possesses all the virtues of the root, and in nervous derangements, as *chorea*, *epilepsy*, etc., is much superior to the resin from the root in action and efficiency. It is decidedly more narcotic and antispasmodic than this resin. I make extensive and successful use of it in *epilepsy*, *chorea*, *delirium tremens* (in which I combine it with quinine), *nervous excitability*, and many *spasmodic affections*. Persons subject to *cramps* will be speedily and permanently relieved by the employment of this extract combined with the extract of cramp bark. The alcoholic extract of black cohosh may be used in all instances where the employment of the root is indicated. The dose is from 1 to 5 or 10 grains, 3 times a day (J. King).

EXTRACTUM CIMICIFUGÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF CIMICIFUGA.

Preparation.—"Cimicifuga, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol, until the cimicifuga is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This preparation has a dark, reddish-brown color like laudanum, is transparent, and possesses the bitter, disagreeable taste of the root in a marked degree. Its flavor may be improved by the addition of white sugar, and a small portion of some aromatic essence at the time of taking it. Fluid extract of black cohosh possesses tonic, narcotic, antispasmodic, alterative, and emmenagogue properties. It may be used with advantage in *rheumatism*, *neuralgia*, *scrofula*, *syphilis*, *amenorrhœa*, *dysmenorrhœa*, *chorea*, and all diseases in which the root is indicated. The dose is from 10 to 60 minims.

EXTRACTUM CINCHONÆ (U. S. P.)—EXTRACT OF CINCHONA.

SYNONYM: *Extract of calisaya bark.*

Preparation.—"Cinchona, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, three thousand cubic centimeters (3000

Cc.) [101 fl℥, 212 ♏]; water, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]; diluted alcohol, a sufficient quantity. Mix the alcohol and water, and, having moistened the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then diluted alcohol, until four thousand cubic centimeters (4000 Cc.) [8 O, 7 fl℥, 122 ♏] of the tincture are obtained, or the cinchona is exhausted. Distill off the alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—If the directions above given are closely followed, and too great a degree of heat avoided, a representative preparation will result. Extract of cinchona has the bitterness of the bark, a red-brown color, and does not wholly dissolve in water. Its tendency to become tough in time may be prevented by incorporating with it while still warm, 10 per cent of glycerin. Its uses are those of cinchona, and the dose is from 10 to 30 grains.

EXTRACTUM CINCHONÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF CINCHONA.

SYNONYMS: *Fluid extract of yellow cinchona bark, Fluid extract of calisaya bark.*

Preparation.—"Cinchona, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycerin, two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏]; alcohol, water, each, a sufficient quantity, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of alcohol. Moisten the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of the mixture, pack it firmly in a cylindrical percolator, and pour on the remainder of the menstruum. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, and, when the liquid in the percolator has disappeared from the surface, gradually pour on a mixture of alcohol and water, made in the proportion of eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of alcohol to two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of water, and continue the percolation until the cinchona is exhausted. Reserve the first seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough of a mixture of alcohol and water, using the same proportions as before, to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This preparation contains all the alkaloidal principles of cinchona, and has a rich deep red-brown color. It is moderately thin and translucent, and possesses the bitterness and astringency of the bark. Its properties are those of cinchona, and it may be used alone or in combination with other agents. Used chiefly as a tonic in doses of ½ to 1 fluid drachm.

EXTRACTUM COCÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF COCA.

SYNONYMS: *Extractum erythroxyli fluidum* (*U. S. P.*, 1880), *Fluid extract of erythroxylon.*

Preparation.—"Coca, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the coca is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Coca*). Fluid extract of coca is of a deep greenish-brown or olive-brown color. It has the bitterness and astringency of the leaves, as well as the feebly aromatic, tea-like flavor. Its odor is slight. Dose, 10 to 60 minims.

EXTRACTUM COFFEÆ VIRIDIS FLUIDUM (N. F.)—FLUID EXTRACT OF GREEN COFFEE

Preparation.—*Formulary number*, 148: "From the commercial, unroasted seeds of *Coffea arabica*, Linné (*Coffee*). *Process B* (see F. 135). No. 20 powder. *Menstruum I:* Alcohol, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; water, six hundred and eighty-five cubic centimeters (685 Cc.) [23 fl℥, 78 ♏]; glycerin, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]. *Menstruum II:* Alcohol, 1 volume; water, 3 volumes. *Note.*—It is recommended that the best quality of either of the commercial varieties known as Java or Mocha coffee be employed for this preparation"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Caffea*). Dose, 5 to 60 minims.

EXTRACTUM COFFEÆ TOSTÆ FLUIDUM (N. F.)—FLUID EXTRACT OF ROASTED COFFEE.

Preparation.—*Formulary number*, 149: "From the commercial roasted seeds of *Coffea arabica*, Linné (*Coffee*). *Process B* (see F. 135). No. 20 powder. *Menstruum I:* Alcohol, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; water, six hundred and eighty-five cubic centimeters (685 Cc.) [23 fl℥, 78 ♏]; glycerin, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]. *Menstruum II:* Alcohol, 1 volume; water, 3 volumes. *Note.*—See the note to the preceding"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Caffea*). Dose, 5 to 60 minims.

EXTRACTUM COLCHICI RADICIS (U. S. P.)—EXTRACT OF COLCHICUM ROOT.

SYNONYMS: *Extractum colchici aceticum* (*U. S. P.*, 1870), *Acetic extract of colchicum.*

Preparation.—"Colchicum root, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; acetic acid, three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏]; water, a sufficient quantity. Mix the acetic acid with fifteen hundred cubic centimeters (1500 Cc.) [50 fl℥, 346 ♏] of water, and, having moistened the powder with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of the mixture, pack it moderately in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then water, until the colchicum root is exhausted. Evaporate the percolate in a porcelain vessel, by means of a water-bath, at a temperature not exceeding 80° C. (176° F.), to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This is a soft extract, bitter to the taste and brown in color. Its solution in water is somewhat turbid. Uses those of colchicum, and employed mostly in pills. Dose, ¼ to 2 grains.

EXTRACTUM COLCHICI RADICIS FLUIDUM (U. S. P.)—FLUID EXTRACT OF COLCHICUM ROOT.

Preparation.—"Colchicum root, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, and, having moistened the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of the mixture, pack it moderately in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the colchicum root is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Colchicum*). Fluid extract of colchicum root has a deep brownish-red color and a bitter taste. Dose, 1 to 8 minims.

EXTRACTUM COLCHICI SEMINIS FLUIDUM (U. S. P.)—FLUID EXTRACT OF COLCHICUM SEED

Preparation.—Colchicum seed, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, and, having moistened the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the colchicum seed is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Medical Uses and Dosage.—(See *Colchicum*). Dose, 1 to 8 minims.

EXTRACTUM COLOCYNTHIDIS (U. S. P.)—EXTRACT OF COLOCYNTH.

Preparation.—"Colocynth, dried, and freed from the seeds, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity. Reduce the colocynth to a coarse powder by grinding or bruising, and macerate it in thirty-five hundred cubic centimeters (3500 Cc.) [118 fl℥, 167 ♏] of diluted alcohol for 4 days, with occasional stirring; then express strongly and strain through flannel. Pack the residue, previously broken up with the hands, firmly in a cylindrical percolator, cover it with the strainer, and gradually pour diluted alcohol upon it until the tincture and expressed liquid, mixed together, measure five thousand cubic centimeters (5000 Cc.) [10 O, 9 fl℥, 33 ♏]. Distill off the alcohol from the mixture by means of a water-bath; evaporate the residue to dryness, and reduce the dry mass to powder. Extract of colocynth should be kept in well-stoppered bottles"—(*U. S. P.*).

Medical Uses and Dosage.—Used chiefly in preparing the compound extract. As water extracts a large amount of mucilaginous and other inert material, the proportion of water should never be greater than that above directed. This extract is laxative and cathartic, according to the dose employed. Dose, from ½ to 2 grains.

EXTRACTUM COLOCYNTHIDIS COMPOSITUM (U. S. P.)

COMPOUND EXTRACT OF COLOCYNTH.

Preparation—"Extract of colocynth, one hundred and sixty grammes (160 Gm.) [5 ozs. av., 282 grs.]; purified aloes, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; cardamom, in No. 60 powder, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; resin of scammony, in fine powder, one hundred and forty grammes (140 Gm.) [4 ozs. av., 411 grs.]; soap, dried and in coarse powder, one hundred and forty grammes (140 Gm.) [4 ozs. av., 411 grs.]; alcohol, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏︎]. Heat the aloes, contained in a suitable vessel, on a water-bath, until it is completely melted; then add the alcohol, soap, extract of colocynth, and resin of scammony, and heat the mixture at a temperature not exceeding 120° C. (248° F.), until it is perfectly homogeneous, and a thread taken from the mass becomes brittle when cool. Then withdraw the heat, thoroughly incorporate the cardamom with the mixture, and cover the vessel until the contents are cold. Finally, reduce the product to a fine powder. Compound extract of colocynth should be kept in well-stoppered bottles"—(*U. S. P.*). This is the standard cathartic of tradition and authority. Devised before the discovery of resin of podophyllum, the expensive drug scammony, was introduced into it. Experience seems to demonstrate that not only may it be economically replaced by this resin, but with advantage to the effectiveness of the resultant extract.

Medical Uses and Dosage.—Compound extract of colocynth is an active cathartic, and may be employed in all cases where catharsis is indicated. From the difficulty with which pure scammony can be obtained in this country, I would suggest as a substitute for it in the above formula, resin of podophyllum, in powder, *one-fourth* the amount of scammony resin named, and which, by no means, lessens the value or efficiency of the preparation. If a little good extract of hyoscyamus or one part of capsicum, or of oil of cloves, be added to the formula, it will tend very much to prevent any griping or other unpleasant action. This compound extract may be especially used in *constipation*, *torpor of the liver*, *headache*, etc., in doses varying from 3 to 20 grains (J. King).

EXTRACTUM CONDURANGO FLUIDUM.—FLUID EXTRACT OF CONDURANGO.

Preparation.—Take of condurango bark, in moderately fine powder, 16 troy ounces; of a menstruum of alcohol, 3 parts; water, 2 parts (by measure), a sufficient quantity. Moisten the condurango with 6 fluid ounces of the menstruum. Cork tightly in a wide-mouth bottle, and permit the mixture to stand an hour in a warm situation. Then introduce it into a cylindrical percolator, 3 inches in diameter, previously prepared for percolation, according to directions given on page 756, and press moderately. Cover the surface of the powder with a circular piece of filtering paper, held in position with a few fragments of glass or marble, and add fresh menstruum until the percolate appears at the exit. Then cork the exit tightly, cover the percolator, and place it in a warm situation. After 24 hours, loosen the cork, and permit the percolate to pass as fast as it will drop, without running in a stream, until 4 fluid ounces are obtained. Again close the exit, macerate 24 hours, and, in a manner like unto the preceding, draw 4 fluid ounces of percolate. Repeat the maceration, and, in a like manner, draw a third portion of 4 fluid ounces. Reserve and mix the 3 percolates, then continue the percolation until 8 fluid ounces are obtained. Evaporate this latter portion until reduced to the measure of 2 fluid ounces, and mix with the reserved 12 fluid ounces. The surface of the powder must be constantly covered with the menstruum from the commencement, and until the end of the process of percolation.

Description, Medical Uses, and Dosage.—(See *Condurango*). Fluid extract of condurango is dark, reddish-brown in color, of an aromatic taste, slight odor, and, as thus prepared, represents very nearly the quality of drug employed, troy ounce to each fluid ounce of the finished extract. Dose, 10 to 30 minims.

EXTRACTUM CONII (U. S. P.)—EXTRACT OF CONIUM.

SYNONYMS: *Extractum conii alcoholicum* (*U. S. P.*, 1880), *Alcoholic extract of hemlock fruit.*

Preparation.—"Conium, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; acetic acid, twenty cubic centimeters (20 Cc.) [325 ♏]; diluted alcohol, a sufficient quantity. Mix the acetic acid with nine hundred and eighty cubic centimeters (980 Cc.) [33 fl℥, 166 ♏] of diluted alcohol, and, having moistened the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥. 69 ♏] of the mixture, pack it firmly in a cylindrical percolator. Then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until three thousand cubic centimeters (3000 Cc.) [101 fl℥, 212 ♏] of tincture are obtained, or until the conium is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder, in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏], mix this with the reserved portion, and evaporate, at or below the above-mentioned temperature, to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This extract was formerly prepared from the leaves, which gave a variable and uncertain product. As now prepared from the seeds, it is the most variable of the class of extracts. The acetic acid is added to fix the coniine, as it is thought to retard the changes which the product is liable to from heat and exposure. This extract is narcotic, and may be used in all cases where its peculiar influence is desired. The dose is from ⅛ grain to 1, 2, or 3 grains, 2 or 3 times a day.

EXTRACTUM CONII FLUIDUM (U. S. P.)—FLUID EXTRACT OF CONIUM.

SYNONYMS: *Fluid extract of conium seeds*, *Fluid extract of conium fruit*, *Extractum conii fructus fluidum* (*U. S. P.*, 1870).

Preparation.—"Conium, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; acetic acid, twenty cubic centimeters (20 Cc.) [325 ♏]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the acetic acid with nine hundred and eighty cubic centimeters (980 Cc.) [33 fl℥, 166 ♏] of diluted alcohol, and, having moistened the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the conium is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder, in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) (33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Conium*). This process is based upon that of Prof. W. Procter, Jr. (*Proc. Amer. Pharm. Assoc.*, 1859, pp. 271–2; see also *Amer. Disp.*, 15th ed., p. 993). Prof. Procter remarks that in each of the drugs (ergot, conium, lobelia) there exists an alkaloid united with an organic acid, as a salt, which is so unstable in its nature, as to be with each drug partially decomposed by the ebullition of its solution; this tendency is almost completely controlled by acetic acid, at a temperature below 65.5° C. (150° F.), and a quite unexceptionable fluid extract is thus obtained. Fluid extract of conium has a brownish-green color, and the characteristic odor of conium, which is intensified by the addition of caustic potash. It contains the active properties of poison hemlock in a concentrated form, and may be given in doses of from 3 to 10 or 12 minims, according to the effects produced.

EXTRACTUM CONVALLARIÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF CONVALLARIA.

SYNONYM: *Fluid extract of lily of the valley.*

Preparation.—"Convallaria, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the convallaria is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Medical Uses and Dosage.—This represents the virtues of the dry convallaria, but the fresh rhizome is employed in Eclectic medicine. Dose, from 1 to 10 minims.

Related Preparation.—EXTRACTUM CONVALLARIÆ FLORUM FLUIDUM (N. F.). *Fluid extract of convallaria flowers.—Formulary number*, 150: "From the flowers of *Convallaria majalis*, Linné (*Lily of the valley*). *Process A* (see F. 135). No. 40 powder. *Menstruum:* Diluted alcohol"—(*Nat. Form.*). This preparation is scarcely known, and might well be dropped.

EXTRACTUM COPTIS FLUIDUM (N. F.)—FLUID EXTRACT OF COPTIS.

Preparation.—*Formulary number*, 151: "From the rhizome and rootlets of *Coptis trifolia*, Salisbury (*Goldthread*). *Process A* (see F. 135). No. 40 powder. *Menstruum:* Diluted alcohol"—(*Nat. Form.*). This preparation is seldom prescribed, and possesses no qualities that commend it in any way above hydrastis.

Medical Uses and Dosage.—(See *Coptis*). Dose, 5 to 60 minims.

EXTRACTUM CASTANEÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF CASTANEA.

SYNONYM: *Fluid extract of chestnut leaves.*

Preparation.—"Castanea, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Pour five thousand cubic centimeters (5000 Cc.) [10 O, 9 fl℥, 33 ♏] of boiling water upon the powder, allow it to macerate for 2 hours, then express the liquid, transfer the residue to a percolator, and pour water upon it until the powder is exhausted. Evaporate the united liquids, on a water-bath, to two thousand cubic centimeters (2000 Cc.) [67 fl℥, 301 ♏], allow this to cool, and add six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol. When the insoluble matter has subsided, separate the clear liquid, filter the remainder, evaporate the united liquids to seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏], allow this to cool, add the glycerin and enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] "—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Castanea*). This fluid extract is powerfully, but agreeably astringent in taste, and has a red-brown color. The boiling water readily extracts the active virtues of the leaves, and the extract is finally preserved by the addition of alcohol and $\frac{1}{10}$ part of glycerin. In our opinion the infusion of the leaves, made fresh, is superior to this or any other pharmaceutical preparation of chestnut leaves. Dose, ½ to 2 fluid drachms.

EXTRACTUM CORNUS.—EXTRACT OF CORNUS.

SYNONYM: *Extract of dogwood.*

Preparation.—Exhaust coarsely powdered dogwood bark with alcohol, water, of each, a sufficient quantity, proceeding in the same manner as explained for the preparation of Alcoholic Extracts, on page 758.

Medical Uses and Dosage.—Extract of dogwood is tonic and antiperiodic and may be successfully used as a substitute for quinine, in many cases. It will be found useful in *dyspepsia*, *debility of the stomach*, and as a tonic in *dropsical affections* after the water has been evacuated. The dose is from 1 to 5 grains, 3 times a day.

EXTRACTUM CORNUS FLUIDUM.—FLUID EXTRACT OF CORNUS

SYNONYM: *Fluid extract of dogwood.*

Preparation.—Take of dogwood bark, in coarse powder, 16 troy ounces; alcohol, 76 per cent, 4 pints; white sugar, 6 troy ounces; water, a sufficient quantity. Moisten the bark thoroughly with alcohol and let it stand 24 hours; then transfer it to a percolator, and gradually add the rest of the alcohol, returning a little of the first that passes till it runs clear. Reserve, by itself, of the first running, 4 fluid ounces; evaporate the remaining alcoholic tincture that comes through to 4 fluid ounces, and likewise set it aside. To the powder in the percolator add gradually cold water, a sufficient quantity, until the liquid that passes is but slightly impregnated with the properties of the dogwood; evaporate this latter solution to ½ pint, then add the sugar, continue the evaporation until the syrup is reduced to 8 fluid ounces, and while warm, mix in the reserved tincture and extract, and make 1 pint of fluid extract.

Medical Uses and Dosage.—Fluid extract of dogwood is tonic, stimulant, and slightly astringent. It may be used in all cases where tonics are indicated, and will be found beneficial in *female debility*, *leucorrhœa*, etc. The dose is from ½ to 2 fluid drachms.

EXTRACTUM CORYDALIS.—EXTRACT OF CORYDALIS.

SYNONYM: *Extract of turkey corn.*

Preparation.—Exhaust coarsely powdered root of turkey corn, with alcohol, water, each, a sufficient quantity, proceeding in the same manner as explained for the preparation of Alcoholic Extracts, on page 758.

Medical Uses and Dosage.—This extract is tonic and alterative, and may be employed in all cases where tonics are indicated. It is useful in all *scrofulous affections*; and in *syphilitic diseases*, both primary and secondary, it will be found among our most efficient agents. The dose is from 1 to 5 grains, 3 times a day (J. King).

EXTRACTUM CORYDALIS FLUIDUM (N. F.)—FLUID EXTRACT OF CORYDALIS.

Preparation.—*Formulary number*, 154: "From the tubers of *Dicentra canadensis*, De Candolle (*Turkey corn*). *Process A* (see F. 135). No. 60 powder. *Menstruum:* Alcohol, 3 volumes; water, 1 volume"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Corydalis*).

EXTRACTUM COTO FLUIDUM.—FLUID EXTRACT OF COTO.

Preparation.—Take of coto bark, in very fine powder, 16 troy ounces; alcohol, a sufficient quantity. Moisten the coto with 6 fluid ounces of alcohol. Cork tightly in a wide-mouth bottle, and permit the mixture to stand an hour in a warm situation. Then introduce it into a cylindrical percolator, 3 inches in diameter, previously prepared for percolation, according to directions given on page 756, and press very firmly. Cover the surface of the powder with a circular piece of filtering paper held in position with a few fragments of glass or marble, and add alcohol until the percolate appears at the exit. Then cork the exit tightly; cover the percolator, and place it in a warm situation. After 24 hours, loosen the cork, and permit the percolate to pass as fast as it will drop, without running in a stream, until 4 fluid ounces are obtained. Again close the exit, macerate 24 hours, and, in a manner like unto the preceding, draw 4 fluid ounces of percolate. Repeat the maceration, and, in like manner, draw a third portion of 4 fluid ounces. Reserve, and mix the three percolates; then continue the percolation until 8 fluid ounces are obtained. Evaporate this latter portion until reduced to the measure of 2 fluid ounces, and mix with the reserved 12 fluid ounces. The surface of the powder must be constantly covered with alcohol from the commencement, and until the end of the process of percolation.

Description, Medical Uses, and Dosage.—Fluid extract of coto is of a reddish color, possesses an aromatic odor and a hot taste, followed by a numbness of the tongue, and, as thus prepared, it represents very nearly the quality of drug employed, troy ounce to each fluid ounce of the finished extract. A mixture of alcohol and water will produce a much darker fluid extract; but alcohol is the best solvent for the characteristic medicinal principles of the drug, and the coloring matter observed in the aqueous extract is undesirable. The addition of water to the menstruum also renders the finished extract more prone to precipitation.

EXTRACTUM CUBEBÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF CUBEB.

Preparation.—"Cubeb, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol, until the cubeb is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This is a translucent, dark or olive-green fluid having the taste and odor of cubeb. It contains the resin and most of the essential oil. Formerly the oleoresin, made by means of ether, according to a process of Prof. Procter (*Proc. Amer. Pharm. Assoc.*, 1859, pp. 272–3), was prepared and sold as fluid extract of cubeb. Fluid extract of cubeb possesses the virtues of cubeb, and may be given in the dose of from 10 to 30 minims, in water, hydro-alcoholic solution, emulsion, or in capsules, and repeated 3 times a day.

EXTRACTUM CUSSO FLUIDUM (U. S. P.)—FLUID EXTRACT OF KOUSSO.

SYNONYMS: *Extractum brayeræ fluidum* (*Pharm.*, 1880), *Extractum koso fluidum; Fluid extract of brayera.*

Preparation.—"Kousso, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol, until the kousso is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate. Distill off the alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This is a dark, brown-green fluid possessing a disagreeably bitter, acrid taste. It is a remedy for *tapeworm*, but the large doses necessary contain an objectionable quantity of alcohol. The dose has been stated as ½ fluid drachm to 1 fluid ounce. More than ½ fluid ounce, should not, however, be prescribed.

EXTRACTUM CYPRIPEDII.—EXTRACT OF CYPRIPEDIUM.

SYNONYM: *Extract of yellow ladies'-slipper.*

Preparation.—Exhaust coarsely powdered yellow ladies'-slipper root, with alcohol, water, each, a sufficient quantity, proceeding in the same manner as explained for the preparation of Alcoholic Extracts, on page 758.

Medical Uses and Dosage.—This extract is tonic and antispasmodic, and may be used to fulfil all the indications of the crude root in *hysteria*, *chorea*, *nervous headache*, and *nervous irritability*. It may be, in many cases, advantageously combined with the alcoholic extract of scullcap. Its dose is from 1 to 5 grains 2 or 3 times a day.

EXTRACTUM CYPRIPEDII FLUIDUM (U. S. P.)—FLUID EXTRACT OF CYPRIPEDIUM.

Preparation.—"Cypripedium, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the cypripedium is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This is a deep, reddish-brown fluid fully representing cypripedium. Fluid extract of cypripedium is tonic, nervine, and antispasmodic, and may be beneficially employed in *chorea*, *hysteria*, *nervous headache*, and all cases of *nervous irritability* and *excitability*. A few drops of oil of anise may be added to it to improve its flavor. The dose is from 10 to 30 minims 3 times a day.

EXTRACTUM DIGITALIS (U. S. P.)—EXTRACT OF DIGITALIS.

SYNONYM: *Extractum digitalis alcoholicum*

Preparation.—"Digitalis, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity. Mix six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until three thousand cubic centimeters (3000 Cc.) [101 fl℥, 212 ♏] of tincture are obtained, or the digitalis is exhausted. Distill off the alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, at a temperature not exceeding 50° C. (122° F.) to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Digitalis*). This is a greenish-brown extract, and, as with conium, an excessive heat must be avoided in its preparation. It has not found much favor among therapeutists. The dose is ¼ grain gradually increased to 1 grain. It should be remembered that digitalis acts slowly, and the extract must not be pushed too rapidly.

EXTRACTUM DIGITALIS FLUIDUM (U. S. P.)—FLUID EXTRACT OF DIGITALIS.

Preparation.—"Digitalis, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the digitalis is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract, dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This produces a dark, greenish-brown, or greenish-black, fluid extract, which is likely to deposit a sediment on standing. The dose is from ½ to 2 minims.

EXTRACTUM DIOSCOREÆ.—EXTRACT OF DIOSCOREA.

SYNONYM: *Dioscorein.*

Preparation.—Make a saturated tincture of the powdered root of Dioscorea villosa, and filter; add the tincture to its weight of water, and carefully distill off the alcohol; the resinoid principle will be left behind in the water, collect, dry, and pulverize it. This is the original formula as named to me by Mr. Wm. S. Merrell, for its preparation, about the time of its introduction to the profession.

History and Description.—The profession is indebted to Mr. Wm. S. Merrell for the preparation and introduction of this agent; it having been first prepared by him in the winter of 1852–3. Dr. T. L. A. Greve states that the article which has been sold for some years past, and is still sold under the name of *Dioscorein*, is the alcoholic extract of the root, dried and powdered (King). This statement of Dr. Greve is in accordance with our views, and we believe that the term *Dioscorein* is improper. This preparation and a few others of similar composition are retained in the class of extracts which they occupied in preceding editions of this publication. (See remarks on resinoids and concentrations under *Resina Podophylli*).

Medical Uses and Dosage.—Extract of dioscorea possesses the properties of the crude root in an eminent degree, and is undoubtedly as much a specific in *bilious colic*, as quinine is in intermittents. In a severe case of bilious colic, pronounced past hope by several physicians, 4 grains rubbed up with a tablespoonful of brandy afforded prompt relief, and a repetition of the dose, in about 20 minutes from the time of taking the first, effected a cure. In ordinary cases, 1 or 2 grains of this extract may be administered every 5, 10, or 20 minutes, according to the urgency of the case. In *flatulence*, *borborygmi*, etc., it may be advantageously combined with ginger, extract of aletris, or of asclepias; in many forms of *uterine disease* its union with resin of black cohosh, oleoresin of senecio, resin of blue cohosh, etc., will prove very useful; and it may be combined with the extract of Cornus sericea, to overcome the *nausea* and *vomiting of pregnant females*. In *cramp of the stomach*, or *painful spasmodic affections of the bowels*, a pill or powder composed of equal parts of extract of dioscorea, resin of blue cohosh, and extract of high cranberry bark, will be found a remedy of great value, as well as in *after-pains:* the mixture should be given in 3 or 4-grain doses, and repeated every half hour or hour. It is strictly an American remedy, of great value. Dose, from 1 to 4 grains, repeated as circumstances require (J. King).

EXTRACTUM DULCAMARÆ.—EXTRACT OF DULCAMARA.

SYNONYM: *Extract of bittersweet.*

Preparation.—Exhaust the bark of the root and twigs of bittersweet, coarsely powdered, with alcohol, water, each, a sufficient quantity, proceeding in the same manner as explained for the preparation of Alcoholic Extracts, on page 758.

Medical Uses and Dosage.—The extract of bittersweet possesses the active properties of the plant, and may be beneficially employed in *scrofula*, *syphilis*, *cutaneous diseases*, and wherever the plant is indicated. The dose is from 2 to 10 or 20 grains, 3 times a day.

EXTRACTUM DULCAMARÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF DULCAMARA.

SYNONYM: *Fluid extract of bittersweet.*

Preparation.—"Dulcamara, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder, and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the dulcamara is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Dulcamara*). A thickish, deep-brown fluid, representing the virtues of bittersweet. Dose, 10 to 60 minims, well diluted with water.

EXTRACTUM EPIGÆÆ FLUIDUM.—FLUID EXTRACT OF EPIGÆA.

SYNONYM: *Fluid extract of trailing arbutus.*

Preparation.—Take of the recently dried leaves of Epigæa repens, in coarse powder, 16 troy ounces; alcohol, a sufficient quantity; diluted alcohol, a sufficient quantity. Moisten the leaves thoroughly with some of the alcohol, and let it stand for 24 hours; then transfer to a percolator, and gradually add the rest of the alcohol, returning a little of the first that passes, until it runs clear. Reserve, by itself, of the first running, 12 fluid ounces; then add gradually a sufficient quantity of diluted alcohol, until the liquid that passes is but slightly impregnated with the taste of the leaves; evaporate this latter solution to 4 fluid ounces, then mix in the reserved tincture and make 1 pint of fluid extract. This fluid extract is subject to disintegration, the product being a gelatinous pectin-like magma or mush.

Medical Uses and Dosage.—The fluid extract of trailing arbutus possesses diuretic and astringent properties, and will be found superior to the preparations of uva ursi, buchu, etc., in *gravel*, and various other disorders of the urinary organs. It may likewise be used in *chronic diarrhœa* and *summer complaint.* The dose is 1 fluid drachm, 3 or 4 times a day (J. King).

EXTRACTUM ERGOTÆ (U. S. P).—EXTRACT OF ERGOT.

SYNONYMS: *Ergotin*, *Extractum hæmostaticum.*

Preparation.—"Fluid extract of ergot, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]. Evaporate the fluid extract of ergot in a porcelain capsule, by means of a water-bath, at a temperature not exceeding 50° C. (122° F.), constantly stirring, until it is reduced to a pilular consistence"—(*U. S. P.*).

The *British Pharmacopœia* process is based on Bonjean's. It consists in evaporating to a syrupy consistence 4 fluid ounces of liquid ergot (prepared chiefly with water), adding 4 fluid ounces of rectified spirit, filtering, and evaporating to a soft extract. This corresponds with *Bonjean's Ergotin.*

Description, Medical Uses, and Dosage.—(See *Ergota*). The *U. S. P.* process originated with Dr. Edward R. Squibb. The product is essentially that known as *Ergotin.* It is a pale-brown, or reddish-brown extract, wholly soluble in diluted alcohol, insoluble in cold alcohol, and dissolves in water, with the exception of a slight residue, yielding a garnet-red solution. Dose, 3 to 20 grains. It may be given hypodermatically by dissolving 5 parts in 7 parts each of water and glycerin, and filtering the solution.

EXTRACTUM ERGOTÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF ERGOT.

Preparation.—"Ergot, recently ground and in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; acetic acid twenty cubic centimeters (20 Cc.) [325 ♏]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the acetic acid with nine hundred and eighty cubic centimeters (980 Cc.) [33 fl℥, 66 ♏] of diluted alcohol, and having moistened the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the ergot is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder, in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This process gives a clear fluid, of a dark-brown color, somewhat red, possessing a taste like ergot, and developing the peculiar fishy smell of trimethylamine, when liquor potassæ is added to it. This process is essentially that of Prof. W. Procter, Jr., who recommended the use of an acid to fix the alkaloidal principles. Prof. Procter suggested another process wherein ether was employed, but this was subsequently discarded. The fluid extract may be used as a substitute for ergot in all cases. It is pleasant to the taste, is always ready for use, requires a small dose, and acts promptly without nausea. The dose is from ½ to 4 fluid drachms. A fluid drachm is about equal to 2 doses of powdered ergot.

Related Preparation.—FLUID ERGOT. Prof. C. S. Hallberg commends the following fluid ergot: "Upon the investigations of Dragendorff, Podwissotzky, Blumberg, and others having been made public, new processes were adopted for preparations that would conform to these theories. The writer constructed a formula for a preparation termed fluid ergot, in contradistinction to the official fluid extract. As this article has proved, during several years increasing use, its superiority over the ordinary fluid extract, and clinical experience sustained the views held in regard to it on theoretical grounds, the process for its preparation might be of interest. The powdered, purified ergot, prepared as above, is digested with twice its weight of water at 65.5° C. (150° F.), for 24 hours and expressed, the residue is again macerated in warm water for 12 hours. After settling, the expressed liquids are strained and evaporated separately, when both together measure one-half as much as the ergot employed. They are mixed and sufficient alcohol added to make the liquid of 25 per cent alcoholic strength, or one third as much as the aqueous solution. After standing, the liquid is filtered and the gummy residue washed with so much 25 per cent alcohol as to make the filtered liquid measure three-fourths, or 75 per cent of the amount of the crude drug employed (volume for weight). To this glycerin is added to make the finished preparation represent the amount of crude ergot originally used (pint for pound). As will be seen, this preparation contains 18 per cent alcohol, rendering it unobjectionable for hypodermatic use. Fluid ergot is an opalescent, amber-colored liquid, possessing a peculiar musty odor. It remains pretty clear unless exposed for a long time to the light or atmosphere. It should, therefore, be kept in small, well-filled bottles in a cool, dark place" (*Amer. Jour. Pharm.*, 1883, p. 11).

EXTRACTUM ERIODICTYI FLUIDUM (U. S. P.)—FLUID EXTRACT OF ERIODICTYON.

SYNONYM: *Fluid extract of yerba santa.*

Preparation.—"Eriodictyon, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of alcohol with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the eriodictyon is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). According to our experience, this preparation should be made with official alcohol. The characteristic constituents of the drug are resinous and incompatible with water. This fluid extract was introduced by Parke, Davis & Co., and it was through their efforts that it attained its present popularity.

Description, Medical Uses, and Dosage.—(See *Eriodictyon*). The menstruum here employed fully extracts the virtues of yerba santa. Fluid extract of eriodictyon is dark brownish-green in color, and possesses the exact odor and taste of the plant, and, if made with alcohol 0.820, represents very nearly the quality of drug employed, troy ounce to each fluid ounce of the finished extract. It may be used to conceal the bitter taste of quinine. The dose ranges from 10 to 60 minims.

EXTRACTUM EUCALYPTI FLUIDUM (U. S. P.)—FLUID EXTRACT OF EUCALYPTUS.

Preparation.—"Eucalyptus, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lb. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder, and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the eucalyptus is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). We prefer the following formula:

"Take of eucalyptus leaves, in moderately fine powder, 16 troy ounces; alcohol, a sufficient quantity. Moisten the eucalyptus with 6 fluid ounces of alcohol. Cork tightly in a wide-mouth bottle, and permit the mixture to stand an hour in a warm situation. Then introduce it into a cylindrical percolator, 3 inches in diameter, previously prepared for percolation, according to directions given on page 756, and press very firmly. Cover the surface of the powder with a circular piece of filtering paper, held in position with a few fragments of glass or marble, and add alcohol until the percolate appears at the exit. Then cork the exit tightly; cover the percolator, and place it in a warm situation. After 24 hours, loosen the cork, and permit the percolate to pass as fast as it will drop, without running in a stream, until 4 fluid ounces are obtained. Again close the exit, macerate 24 hours, and in a manner like unto the preceding, draw 3 fluid ounces of percolate. Repeat the maceration, and, in like manner, draw a third portion of 3 fluid ounces. Lastly, mix the 3 percolates. The surface of the powder must be constantly covered with alcohol from the commencement, and until the end of the process of percolation."

Description, Medical Uses, and Dosage.—(See *Eucalyptus*). Fluid extract of eucalyptus is dark brownish-green, or green, in color, and possesses the taste and odor of the leaves, and, as thus prepared, represents very nearly the quality of drug employed, troy ounce to each fluid ounce of the finished extract. In our experience this preparation should be made with alcohol. Water is injurious in proportion to the amount present. We, therefore, supplement the above with a formula long established in our hands and published in the supplement to the last edition of this Dispensatory. Dose, 1 to 10 minims.

EXTRACTUM EUONYMI (U. S. P.)—EXTRACT OF EUONYMUS.

SYNONYM: *Extract of wahoo.*

Preparation.—"Euonymus, in No. 30 powder, one thousand grammes (1000 Gm. [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity. Mix six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until three thousand cubic centimeters (3000 Cc.) [101 fl℥, 212 ♏) of tincture are obtained or the euonymus is exhausted. Distill off the alcohol from the tincture by means of a water-bath, and having placed the residue in a porcelain capsule, evaporate it, on a water-bath, to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Euonymus*). A brown or yellowish-brown extract, the dose of which is from 1 to 5 grains.

EXTRACTUM EUPATORII.—EXTRACT OF EUPATORIUM.

SYNONYM: *Extract of boneset.*

Preparation.—Exhaust the tops and leaves of boneset, bruised, with water, a sufficient quantity, proceeding in the same manner as explained for the preparation of Aqueous Extracts, on page 758.

Medical Uses and Dosage.—Extract of boneset is tonic and aperient, and may be given with advantage in convalescence from exhausting diseases, *intermittent fever, dyspepsia, debility of the digestive organs*, and *general debility*. The dose is from 1 to 10 grains 2 or 3 times a day.

EXTRACTUM EUPATORII FLUIDUM (U. S. P.)—FLUID EXTRACT OF EUPATORIUM.

SYNONYM: *Fluid extract of boneset.*

Preparation.—"Eupatorium, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the eupatorium is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Eupatorium*). This is a dark green-brown or brownish-red liquid representative of the herb. Dose, from 10 to 60 minims.

EXTRACTUM FERRI POMATUM (N. F.)—FERRATED EXTRACT OF APPLES.

SYNONYMS: *Ferri malas crudus, Crude malate of iron.*

Preparation.—*Formulary number*, 156: "Iron, in the form of fine, bright wire, and cut, twenty grammes (20 Gm.) [309 grs.]; ripe sour apples, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; water, a sufficient quantity. Convert the sour apples into a homogeneous pulp by pounding or grinding, and express the liquid portion. Then mix the latter with the iron in an enameled or porcelain vessel, macerate for 48 hours, and then apply the heat of a water-bath until no more bubbles of gas are given off, adding a little water from time to time to make up any loss by evaporation. Dilute the liquid with water to make it weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.], and set it aside for a few days. Then filter, and evaporate the filtrate in the before-mentioned vessel, to a thick extract, which should be greenish-black, and should yield a clear solution with water. *Note.*—This preparation is inserted here with the title under which it is contained in the *German Pharmacopœia*. In some others it is called more correctly, *Extractum pomi* (or *pomorum*) *ferratum*"—(*Nat. Form.*).

Medical Uses and Dosage.—The uses and doses of this preparation are similar to those of citrate of iron and other ferruginous salts prepared with the common organic acids. It is a relic of European medieval medicine

EXTRACTUM FRANGULÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF FRANGULA.

Preparation.—"Frangula, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of alcohol with eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of water, and, having moistened the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the frangula is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] "—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Frangula*). This preparation has a deep brownish-red color, and to the taste is both sweetish and bitter. It is an uncertain laxative. Dose, from 10 to 30 minims.

EXTRACTUM FUCI FLUIDUM (N. F.)—FLUID EXTRACT OF FUCUS.

Preparation.—*Formulary number*, 157: "From the thallus of *Fucus vesiculosus*, Linné (*Bladder-wrack*). *Process A* (see F. 135). No. 40 powder. *Menstruum:* Alcohol, 3 volumes; water, 1 volume"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Fucus*). Dose, 5 to 15 minims.

EXTRACTUM GALANGÆ FLUIDUM.—FLUID EXTRACT OF GALANGAL.

Preparation.—Take of galangal root in fine powder, 16 troy ounces; alcohol, a sufficient quantity. Moisten the galangal with 6 fluid ounces of alcohol. Cork tightly in a wide-mouth bottle, and permit the mixture to stand an hour in a warm situation. Then introduce it into a cylindrical percolator, 3 inches in diameter, previously prepared for percolation, according to directions given on page 756, and press very firmly. Cover the surface of the powder with a circular piece of filtering paper, held in position with a few fragments of glass or marble, and add alcohol until the percolate appears at the exit. Then cork the exit tightly; cover the percolator, and place it in a warm situation. After 24 hours, loosen the cork, and permit the percolate to pass as fast as it will drop, without running in a stream, until 4 fluid ounces are obtained. Again close the exit, macerate 24 hours, and, in a manner like unto the preceding, draw 4 fluid ounces of percolate. Repeat the maceration, and, in like manner, draw a third portion of 4 fluid ounces. Reserve and mix the 3 percolates; then continue the percolation until 8 fluid ounces are obtained. Evaporate this latter portion until reduced to the measure of 2 fluid ounces, and mix with the reserved 12 fluid ounces. The surface of the powder must be constantly covered with alcohol from the commencement, and until the end of the process of percolation.

Description, Medical Uses, and Dosage.—Fluid extract of galangal is of a reddish color, and possesses the exact odor and taste of the drug. It should not be black, or thick, and if such is the case with any specimen, it may be inferred that the menstruum used was a mixture of alcohol and water, instead of alcohol. Alcohol freely extracts all the sensible properties of galangal, and the mixture of water or glycerin is objectionable. (For uses, see *Galanga*). Dose, 5 to 30 minims.

EXTRACTUM GELSEMII FLUIDUM (U. S. P.)—FLUID EXTRACT OF GELSEMIUM.

Preparation.—"Gelsemium, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol, until the gelsemium is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Gelsemium*). This fluid has a deep reddish-brown color and the bitter taste and characteristic odor of gelsemium. Eclectic physicians have no confidence in this or any other preparation made of dry gelsemium root. This, too, notwithstanding the assertions of some who claim that the alkaloid *gelsemine* dominates the drug, and is identical in both the fresh and the dry root. Dose, 1 to 5 minims.

EXTRACTUM GENTIANÆ (U. S. P.)—EXTRACT OF GENTIAN.

Preparation.—"Gentian, in No. 20 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; water, a sufficient quantity. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of water, and let it macerate for 24 hours; then pack it in a conical percolator, and gradually pour water upon it until the infusion passes but slightly imbued with the properties of the gentian. Reduce the liquid to three-fourths of its bulk by boiling, and strain; then, by means of a water-bath, evaporate to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—Extract of gentian is a tenacious, shining, dark-brown or blackish product, very bitter to taste, but pleasant in odor. The principles are extracted by cold water, while the starch and pectin remain in the powder. By subsequent boiling the albuminous matter is separated. This extract is a tonic, and may be used wherever this indication is present, either alone or in conjunction with other tonics. The dose is from 1 to 10 grains.

EXTRACTUM GENTIANÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF GENTIAN.

Preparation.—"Gentian, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the gentian is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate. Distill off the alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥. 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This extract has a dark reddish-brown color, is translucent and free from sediment, and transparent in thin strata. It possesses the taste and odor of gentian. Tonic, and may be given in doses of from ½ to 1 fluid drachm, which represent ½ to 1 drachm of gentian root. It may be variously combined with other agents to meet particular indications. For instance, should an aperient tonic, with antacid properties be desired, the following form may be used: Take of fluid extract of gentian, 2 fluid ounces; fluid extract of rhubarb, 2 fluid drachms; bicarbonate of potassium, 1 drachm; tincture of ginger, 2 fluid drachms. Mix. One fluid drachm of this mixture will be equal to about 40 grains of gentian, 6 of rhubarb, and 3 of bicarbonate of potassium. If a chalybeate tonic is desired, the following may be employed: Take of citrate of iron and quinine, 1 drachm; water, 6 fluid drachms; dissolve, and add fluid extract of gentian, 2 fluid ounces. A fluid drachm of this mixture will represent about 45 grains of gentian, and 3 grains of citrate of iron and quinine (Wm. Procter, Jr.). Dose, 1 to 10 grains.

EXTRACTUM GENTIANÆ FLUIDUM COMPOSITUM.
COMPOUND FLUID EXTRACT OF GENTIAN

Preparation.—Take of gentian, in coarse powder, 16 troy ounces; bitter orange peel, coriander seeds, of each, in coarse powder, 4 troy ounces; water, alcohol, each, a sufficient quantity. Macerate the gentian in 2½ pints of water for 12 hours, and introduce it into a percolator; allow the infusion to pass slowly, adding water at intervals until 5 pints of the liquid have passed. Evaporate this to 10 fluid ounces. Macerate the orange peel and coriander seeds in a mixture of 8 fluid ounces of alcohol, and 4 fluid ounces of water for 12 hours; introduce them into a percolator, and add gradually a sufficient quantity of diluted alcohol to displace 12 fluid ounces of tincture. Evaporate this to 6 fluid ounces by a gentle heat, 48.8° C. (120° F.), add it to the solution of gentian while hot, and strain. When finished, the fluid extract should measure a pint (Wm. Procter, Jr.). This formula can be simplified to advantage by mixing the powders and percolating in the usual manner.

Description, Medical Uses, and Dosage.—The compound fluid extract of gentian is a colored, thin, syrupy liquid. In the preparation of it I should prefer prickly ash berries to the coriander, both on account of their flavor and well-known influence on mucous tissues. Tonic and carminative, and may be given in doses of from ½ to 1 fluid drachm (J. King).

EXTRACTUM GERANII.—EXTRACT OF GERANIUM.

SYNONYM: *Geraniin.*

Preparation and History.—This article was formerly obtained by making a saturated tincture of the root of Geranium maculatum, filtering, distilling off a part of the alcohol, adding water to the residue, and evaporating to dryness. Many manufacturers have preferred to make it by evaporating an aqueous decoction of the root to dryness. Dr. T. L. A. Greve has given me the following statement: "Formerly, the dried and powdered resin of Geranium maculatum was sold under the name of *geraniin*, but was found to be nearly inert; the dried alcoholic extract was then substituted for it under the same name. By the ordinary mode of desiccating this extract, the red tannin, upon which the activity of the root principally, if not exclusively, depends, is almost wholly decomposed, and the resulting '*geraniin*' is quite worthless. A very good preparation may, however, be obtained, by evaporating a saturated tincture of the root to the consistence of thin syrup, then spreading this on glass plates with a brush, and when dry scraping off with a knife. The *geraniin* thus formed is in thin scales, very astringent, and possesses in a great degree, the active properties of the root." This latter is the article now used by the profession (J. King).

This is especially an American remedy. It was first prepared by Mr. Wm. S. Merrell, of Cincinnati, according to the first formula given above, who introduced it to the profession under the name of *Geraniin*; it was a black substance, forming a dark-brown glistening powder of a faint odor, somewhat like that of molasses, and an astringent, acidulous taste, leaving a flavor in the mouth somewhat resembling that of good green tea. Like many other concentrated agents, the name selected for it was entirely inappropriate (see *Concentrations*).

Medical Uses and Dosage.—Extract of geranium is a powerful astringent, and, unlike tannic acid in its action, does not cause a dryness of the mucous surfaces with which it comes in contact, but produces its therapeutical influence upon them with the continuance of their natural moisture. On this account and in connection with its not unpleasant taste, it may be substituted for tannic acid in many of the diseases in which this acid is employed. It may be employed in all instances where astringents are indicated. It has been found a superior article, both in the first and second stages of *dysenteric diarrhœa*, *diarrhœa*, and *cholera morbus*. Equal parts of extracts of geranium and dioscorea, and resin of blue cohosh, will be found a valuable mixture in *diarrhœa* and *cholera morbus*, when much pain and flatulency are present; the mixture may be given in 6-grain doses to an adult, every 15 or 20 minutes, or as often as the urgency of the case may require. Extract of geranium will be found efficient in *hemorrhages*, *hematuria*, *menorrhagia*, *leucorrhœa*, *gleet*, *diabetes*, etc. In *colliquative diarrhœa* it answers an excellent purpose, either alone, or in combination with quinine. Externally, it may be applied to *ulcers*, and combined with alum and gum Arabic, it forms an excellent application to *bleeding wounds* and in *epistaxis*. Dose of the extract, from 1 to 5 grains or more, repeated as required; it may be given in syrup, molasses, gruel, water, or port wine.

EXTRACTUM GERANII FLUIDUM (U. S. P.)—FLUID EXTRACT OF GERANIUM.

Preparation.—"Geranium, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of diluted alcohol, and, having moistened the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterwards diluted alcohol, until the geranium is exhausted. Reserve the first seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Geranium*). This is a deep reddish-brown fluid, with a powerfully astringent taste and but very little odor. It is subject to gelatinization in common with other preparations containing the so-called "red tannates," and it is not uncommon to find the extract change to a brown magma or mush. Dose, ½ to 2 fluid drachms.

EXTRACTUM GLYCYRRHIZÆ (U. S. P.)—EXTRACT OF GLYCYRRHIZA.

SYNONYM: *Extract of liquorice.*

"The commercial extract of the root of *Glycyrrhiza glabra*, Linné (*Nat. Ord.*—Leguminosæ)"—(*U. S. P.*).

Source, History, and Description.—The black cylindrical sticks met with in commerce are an extract of liquorice root (*Extractum Glycyrrhizæ*), which is prepared in some of the southern European countries; they are in the form of hard, black cylinders, which are prepared by inspissating the decoction in copper kettles, till the mass is thick enough to become firm on cooling. Water slowly dissolves from ⅗ to 11/12 of it, alcohol only about ⅛, and acquires an acrid taste, while the residuum is purely sweet, and entirely soluble in water.

The impure extract is in slightly compressed and cylindrical sticks, about 6 inches long, and from 9 to 12 lines in diameter, being enveloped in sweet bay leaves. The best kind is dark brownish-black, smooth, shining, brittle when cold, tough and flexible when warm, very sweet and soluble in water. It should be freed from impurities for internal use.

The *U. S. P.* describes extract of glycyrrhiza: "In flattened, cylindrical rolls, from 15 to 18 Cm. (6 to 7 inches) long, and from 15 to 30 Mm. (½ to 1⅕ inch) thick; of a glossy black color. It breaks with a sharp, conchoidal, shining fracture, and has a very sweet, peculiar taste. Not less than 60 per cent of it should be soluble in cold water"—(*U. S. P.*). To purify liquorice, the crude extract is dissolved in water without boiling, the solution strained, and evaporated to the proper consistence. (See purified extract of liquorice.) If the water be boiled during the purification, much of the impurity may be taken up, which is not desirable. Immense amounts of extract of liquorice, in the form of mass extract, are imported into this country for the use of tobacconists, who employ it to sweeten plug chewing tobacco.

EXTRACTUM GLYCYRRHIZÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF GLYCYRRHIZA.

SYNONYM: *Fluid extract of liquorice root.*

Preparation.—"Glycyrrhiza, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; ammonia water, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the ammonia water with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of alcohol and six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of water, and, having moistened the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then a mixture of alcohol and water, made in the proportion of three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of alcohol and six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of water, until the glycyrrhiza is exhausted. Reserve the first seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough of the mixture of alcohol and water to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description and Medical Uses.—(See *Glycyrrhiza*). Unlike the product of the *U. S. P.*, 1880, this fluid extract contains no glycerin, but some ammonia, which renders the glycyrrhizin soluble, making the preparation sweeter and stronger. No ammonia is contained in the *Liquid extract of liquorice* (*Extractum Glycyrrhizæ Liquidum*) of the *British Pharmacopœia.* Fluid extract of glycyrrhiza is intended to facilitate the dispensing of extract of liquorice in cough mixtures, and for concealing the bitter taste of quinine and quinine mixtures, aloes, and other unpleasantly bitter medicines. By adding fluid extract of liquorice (1 part) to simple syrup (7 parts), a *syrup of liquorice* may be prepared, useful in extemporaneous prescribing of quinine. It must be remembered that mixtures of quinine and liquorice produce unsightly precipitates, which must not be filtered. Fluid extract of liquorice occasionally deposits its glycyrrhizin as a brown precipitate. When this occurs the addition of a small amount of ammonia water will redissolve it.

EXTRACTUM GLYCYRRHIZÆ PURUM (U. S. P.)—PURE EXTRACT OF GLYCYRRHIZA.

SYNONYMS: *Pure extract of liquorice, Extractum glycyrrhizæ depuratum, Succus liquiritiæ depuratus.*

Preparation.—"Glycyrrhiza, in No. 20 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; ammonia water, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; distilled water, a sufficient quantity. Mix the ammonia water with three thousand cubic centimeters (3000 Cc.) [101 fl℥, 212 ♏] of distilled water, and, having moistened the powder with one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of the menstruum, let it macerate for 24 hours. Then pack it moderately in a cylindrical glass percolator, and gradually pour upon it, first, the remainder of the menstruum, and then distilled water, until the glycyrrhiza is exhausted. Lastly, evaporate the infusion, by means of a water-bath, to a pilular consistence"—(*U. S. P.*).

Description and Medical Uses.—(See *Glycyrrhiza*). This is a brown extract, possessing a pleasant sweet taste. It mixes clear with water. The object of the ammonia is to render the glycyrrhizin soluble. Care must be taken in its preparation, lest too great a heat should impart to it an empyreumatic flavor. It is used as a protective demulcent and lenitive in *laryngo-broncho-pulmonic affections*, but chiefly as an adjuvant in various mixtures, and to disguise the bitterness of quinine, with which it forms an insoluble compound. All mixtures of quinine and liquorice should be given in substance, never filtered.

Related Preparation.—EXTRACTUM GLYCYRRHIZÆ DEPURATUM (N. F.), *Purified extract of glycyrrhiza, Purified extract of liquorice.—Formulary number*, 158: "Extract of glycyrrhiza, in sticks; water, each, a sufficient quantity. Put a layer of well-washed rye-straw over the bottom of a keg or other suitable tall vessel. Then put a single layer of sticks of extract of glycyrrhiza, broken into coarse pieces, over it. Continue to put in alternate layers of straw and extract of glycyrrhiza until the vessel is full, or the whole of the extract has been disposed of. Fill the vessel with cold water, and allow it to remain for 3 days. Then draw off the solution which has formed, by means of a faucet, or siphon, or otherwise, refill the vessel with cold water, and proceed as before. Mix the several solutions obtained, allow any suspended matter to subside, decant the clear solution, and strain the remainder without pressure. Finally evaporate the liquid on a water-bath to the consistence of a pilular extract. *Note.*—Purified extract of glycyrrhiza should not be confounded with the official pure extract of glycyrrhiza (*Extractum Glycyrrhizæ Purum*)" (*Nat. Form.*). See above.

EXTRACTUM GOSSYPII.—EXTRACT OF GOSSYPIUM.

SYNONYM: *Extract of cotton-root bark.*

Preparation.—Exhaust the recent inner bark of the root of the cotton plant, in small pieces, with water, a sufficient quantity, proceeding in the same manner as explained for the preparation of Aqueous Extracts, on page 758. The pilular extract should be placed in small jars, and kept well covered, to prevent, as much as possible, any loss of its virtues. Unless made of the recent root it will be inert, and even then it is a question as to whether the heat of concentration does not materially affect the product.

Medical Uses and Dosage.—Extract of cotton-root bark is emmenagogue and abortifacient. It will be found useful in *amenorrhœa* and *dysmenorrhœa*, combined with belladonna and quinine. The dose is from 1 to 5 or 10 grains, 3 times a day (J. King).

EXTRACTUM GOSSYPII RADICIS FLUIDUM (N. F.)—FLUID EXTRACT OF COTTON-ROOT BARK.

Preparation.—"Cotton-root bark, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycerin, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol, and, having moistened the powder with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then alcohol, until the cotton-root bark is exhausted. Reserve the first seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Gossypium*). This preparation is a bright-red fluid. It should be prepared from the recently dried root bark. Dose, ½ to 1 fluid drachm.

Gossypium fluid extract is typical of those red-tannin liquids that disintegrate spontaneously. The product is a brown magma and a watery serum. No explanation has been given for this change, which occurs without warning, and which may affect only a few bottles in a batch.

EXTRACTUM GRINDELIÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF GRINDELIA.

Preparation.—"Grindelia, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 oz., 120 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol until the grindelia is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate. Distill off the alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Grindelia*). This well represents the virtues of grindelia, the activity of which probably depends upon its resin and essential oil, alcohol being, therefore, the proper menstruum. It is a dark brown-green fluid, having the characteristic odor of the plant, and does not mix well with water owing to the abundance of resinous material present, which separates when so treated. This fluid extract was originated by Parke, Davis & Co., of Detroit, to whom belongs the credit of its introduction. Dose, 10 to 60 minims.

EXTRACTUM GUARANÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF GUARANA.

Preparation.—"Guarana, in No. 80 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and, having moistened the powder with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the guarana is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate. Distill off the alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Guarana*). This is a dark reddish-brown fluid, of an astringent bitter taste. If too little alcohol be used in the menstruum, as in former processes, a heavy precipitate falls. Glycerin, in our opinion, is desirable as a part of the menstruum, both as a solvent and as a preventive of precipitation. Dose, from 20 to 60 minims.

EXTRACTUM HAMAMELIDIS FLUIDUM (U. S. P.)—FLUID EXTRACT OF HAMAMELIS.

Preparation.—"Hamamelis, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; alcohol, water, each a sufficient quantity. Mix the glycerin with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of alcohol, and eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of water, and, having moistened the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of the mixture, pack it firmly in a conical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then a mixture of alcohol and water, made in the proportion of five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of alcohol to eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of water, until the hamamelis is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Hamamelis*). This fluid has a deep red-brown color, and the bitter and astringent taste of witch-hazel leaves. This fluid extract fully represents the virtues of hamamelis and may be employed to fulfil the indications for that drug, particularly where the action of an astringent is desired. It should not be confounded with *Aqua Hamamelidis*, which is often called extract of witch-hazel. Dose, from 10 to 30 minims.

EXTRACTUM HÆMATOXYLI (U. S. P.)—EXTRACT OF HÆMATOXYLON.

SYNONYMS: *Extract of logwood, Extractum ligni campechiani.*

Preparation.—"Hæmatoxylon, rasped, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; water, ten thousand cubic centimeters (10,000 Cc.) [338 fl℥, 66 ♏]. Macerate the hæmatoxylon with the water for 48 hours. Then boil (avoiding the use of metallic vessels) until one-half of the water has evaporated; strain the decoction while hot, and evaporate to dryness"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—The above process should not be carried on in an iron vessel, on account of the astringent principle present. Extract of logwood should be a dry, non-hygroscopic, fragile, pulverulent mass, of a ruby-red color and a sweet taste, followed by astringency. Brande states that 20 pounds of the extract may be obtained from a hundred-weight of the rasped wood. The usual yield. however, is about 12 per cent. Old extract becomes very hard, frequently passing through the bowels undissolved when given in pills, and should, therefore, not be used in their preparation, but only in solutions. It forms a nearly clear, ruby-red solution in water. It is largely prepared where logwood is indigenous, and is much used in the arts.

Extract of logwood is astringent and tonic, and will be found useful in *diarrhœa*, *dysenteric diarrhœa*, relaxed conditions of the bowels succeeding *cholera infantum*, and in *chronic laryngitis* or *bronchitis* accompanied with considerable mucous expectoration. The dose is from 5 to 30 grains, 2 or 3 times a day. In 3 cases of *chronic diarrhœa*, with mucous, bloody, and purulent discharges of the bowels, from ulceration of the colon, Prof. A. J. Howe, M. D., succeeded in arresting the abnormal evacuations, when several approved remedies had been tried in vain, by means of a strong solution of extract of logwood. About 2 ounces of the extract were dissolved in a pint of warm water, of which, when cold, a tablespoonful was given for a dose, repeating it every 3 hours.

EXTRACTUM HUMULI FLUIDUM (N. F.)—FLUID EXTRACT OF HOPS.

Preparation.—*Formulary number*, 160: "From the strobiles of *Humulus Lupulus*, Linné (*Hops*). *Process A* (see F. 135). No. 20 powder. *Menstruum:* Alcohol, 5 volumes; water, 3 volumes"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Humulus*). Dose, 10 to 60 minims.

EXTRACTUM HYDRANGEÆ FLUIDUM (N. F.)—FLUID EXTRACT OF HYDRANGEA.

Preparation.—*Formulary number*, 161: "From the root of *Hydrangea arborescens*, Linné (*Seven barks*). *Process A* (see F. 135). No. 60 powder. *Menstruum:* Alcohol, 3 volumes; water, 2 volumes"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Hydrangea*). Valuable in *irritable conditions of the urethra and bladder*, from the presence of *stone* or *gravel*, etc., and to change the character of *lithic urine*. The dose is from ½ to 1 fluid drachm.

EXTRACTUM HYDRASTIS.—EXTRACT OF HYDRASTIS.

SYNONYM: *Extract of golden seal.*

Preparation.—Mix powdered golden-seal root with enough diluted alcohol to thoroughly moisten it; in 24 hours put the whole into a percolator, and exhaust with diluted alcohol. Distill the alcohol from this filtered tincture, and evaporate the remainder to the consistence of an extract.

Medical Uses and Dosage.—This extract possesses all the tonic virtues of the root, and may be used in all cases where it is indicated. In many instances it will be preferable to the hydrochlorate of berberine, on account of the insolubility of the latter. The dose is from 2 to 5 grains, 3 times a day (J. King).

EXTRACTUM HYDRASTIS FLUIDUM (U. S. P.)—FLUID EXTRACT OF HYDRASTIS.

Preparation.—"Hydrastis, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lb. av., 3 ozs., 120 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol, and three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, and, having moistened the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then a mixture of alcohol and water, made in the proportion of six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol to three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, until the hydrastis is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate. Distill off the alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Hydrastis*). This preparation has a dark brownish-yellow color, and the characteristic and bitter taste of golden seal. The glycerin has no value that we can discover, and might well be replaced with advantage by a like volume of alcohol. Dose, 10 to 60 minims.

EXTRACTUM HYOSCYAMI (U. S. P.)—EXTRACT OF HYOSCYAMUS.

SYNONYMS: *Extractum hyoscyami alcoholicum, Extract of henbane.*

Preparation.—"Hyoscyamus, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, two thousand cubic centimeters (2000 Cc.) [67 fl℥, 301 ♏]; water, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]; diluted alcohol, a sufficient quantity. Mix the alcohol and water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then diluted alcohol, until three thousand cubic centimeters (3000 Cc.) [101 fl℥, 212 ♏] of the tincture are obtained, or the hyoscyamus is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; mix this with the reserved portion, and evaporate, at or below the before-mentioned temperature, to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Hyoscyamus*). This extract has a greenish-brown or olive color, with the heavy narcotic odor of henbane. Old extracts of hyoscyamus exhibit crystals, which are said to be those of potassium nitrate and sodium chloride. Even the official extract is not considered a first-class therapeutical agent. It contains, in a measure, the medicinal virtues of the henbane, and may be administered whenever this drug is indicated. The dose is from ¼ to 2 or 3 grains, 3 times a day. The smallest dose must first be given, and the quantity gradually increased until the desired influence is experienced.

EXTRACTUM HYOSCYAMI FLUIDUM (U. S. P.)—FLUID EXTRACT OF HYOSCYAMUS.

Preparation.—"Hyoscyamus, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix two thousand cubic centimeters (2000 Cc.) [67 fl℥, 301 ♏] of alcohol with one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the hyoscyamus is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This forms an elegant and durable preparation of hyoscyamus. In percolation the fluid should be allowed to pass very slowly, that thorough exhaustion of the leaves may take place. It has a very deep greenish-brown hue, and the narcotic odor of henbane. This extract possesses all the virtues of hyoscyamus, and may be given wherever the influence of the plant is desired. The dose is 5 minims, increased cautiously to 30 minims, or until the desired action is obtained.

EXTRACTUM IGNATIÆ AMARÆ.—EXTRACT OF IGNATIA.

SYNONYM: *Extract of St. Ignatius' bean.*

Preparation.—Take of St. Ignatius' beans, 1 pound, bruise them in an iron or brass mortar until reduced to small fragments or very coarse powder; moisten them with water in a covered vessel, and apply heat until the tissues of the pieces become soft, and can be bruised into a pulpy mass. Mix this mass with alcohol, 0.820, twice its bulk, and macerate in a close vessel and in a warm place for 24 hours, then place in a percolator, and add alcohol until 10 or 12 pints of tincture have been obtained. Distill off the alcohol, heat the residue in a water-bath until reduced to the consistence of a soft extract. About 10 per cent of a brown extract will be thus obtained, of a peculiar heavy odor, and an intensely bitter taste.

Medical Uses and Dosage.—(See *Ignatia*). Analogous to those of nux vomica, but probably more efficient in *nervous diseases, headaches*, etc. The dose is about ½ grain, 2 or 3 times a day. It is an active and dangerous preparation, and must be used with care (W. Procter, Jr.).

EXTRACTUM IPECACUANHÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF IPECAC.

Preparation.—"Ipecac, in No. 80 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and, having moistened the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the ipecac is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Ipecacuanha*). This is a thin and transparent, deep reddish-brown fluid, with the bitterish, subacrid, nauseous flavor and taste of ipecac. In the preceding revisions of the *U. S. P.*, this fluid extract was made by a process so different as to necessitate special mention. Then the oleoresins were precipitated by water from the evaporated percolate, which was afterward alcoholated enough to preserve it. Acetic acid was also employed. By this method a fluid extract was obtained, capable of mixing with water or syrup in all proportions, the product being clear. The present *U. S. P.* process produces a fluid that neither has the odor of acetic acid, nor is it capable of making a clear syrup by direct admixture with simple syrup (see formula for making syrup of ipecac). Dose, as expectorant, 1 to 5 minims; as an emetic, 15 to 30 minims.

EXTRACTUM IRIDIS (U. S. P.)—EXTRACT OF IRIS.

SYNONYM: *Extract of blue flag.*

Preparation.—"Iris, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol, until three thousand cubic centimeters (3000 Cc.) [101 fl℥, 212 ♏] of tincture are obtained, or the iris is exhausted. Distill off the alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This is a dark-brown extract possessing the odor and taste of the drug. The alcoholic extract of blue flag is a valuable cathartic and alterative. In doses of from 1 to 5 grains or more, it will be found a useful purgative in cases of *obstinate constipation, hepatic torpor, indigestion, amenorrhœa*, etc As a laxative the dose should be smaller. In larger doses it will produce hydragogue results, and may be given with advantage in *chronic pulmonary affections, dropsy, worms*, etc. In doses to fall short of catharsis, it becomes a valuable alterative, and will be found especially useful in *rheumatic diseases*, *scrofula*, *syphilis*, etc., and will frequently cause ptyalism. A few grains of ginger or capsicum will prevent any harshness of action. As an alterative, the dose is from ¼ to 1 grain 3 times a day (J. King).

EXTRACTUM IRIDIS FLUIDUM (U. S. P.)—FLUID EXTRACT OF IRIS.

SYNONYM: *Fluid extract of blue flag.*

Preparation.—"Iris, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lb. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol until the iris is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate. Distill off the alcohol from the remainder by means of a water-bath, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—A dark red-brown fluid. When mixed with water a copious precipitate results; even a few drops impart an opalescence to much water. This fluid extract is subject to disintegration in a similar way to that of gossypium, although the change is not as frequent. The result, when alteration occurs, is a copious brown magma, that sometimes is abundant enough to render the liquid thick like mush. This fluid extract holds the virtues of blue flag in a concentrated state, and may be used in *syphilis*, *dropsy*, *scrofula*, and all diseases in which the crude article is indicated. The dose is from a fraction of a drop to 20 drops.

EXTRACTUM JALAPÆ (U. S. P.)—EXTRACT OF JALAP.

Preparation.—"Jalap, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity. Moisten the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol until the jalap is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 308 ♏] of the percolate. Distill off the alcohol from the remainder by means of a water-bath, and add the residue to the reserved portion, and evaporate to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—The use of water in the preparation of this extract has been abandoned, since it was learned that it extracted none of the active constituents of the drugs. Moreover, it increased the bulk by dissolving inert matter, and rendered the extract more liable to become hygroscopic, and consequently to harden. Extract of jalap is a deep-brown, tenacious extract. It is cathartic in doses of from 10 to 20 grains, but is seldom used alone, being generally added to pills to increase their laxative or cathartic effect.

EXTRACTUM JALAPÆ FLUIDUM (N. F.)—FLUID EXTRACT OF JALAP.

Preparation.—*Formulary number*, 162: "From the tuberous root of *Exogonium Purga*, Bentham (*Jalap*). *Process A* (see F. 135). No. 60 powder. *Menstruum:* Alcohol"—(*Nat. Form.*).

Like the preparations of other resinous drugs this fluid extract precipitates copiously, when mixed with water, and such mixtures must be well shaken before administration.

Medical Uses and Dosage.—(See *Jalapa*). Dose, 10 to 60 minims.

EXTRACTUM JUGLANDIS (U. S. P.)—EXTRACT OF JUGLANS.

SYNONYM: *Extract of butternut.*

Preparation.—"Juglans, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until three thousand cubic centimeters (3000 Cc.) [101 fl℥, 212 ♏] of tincture are obtained, or the juglans is exhausted. Distill off the alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—Diluted alcohol, as shown by B. F. Moise, Jr. (*Amer. Jour. Pharm.*, 1881, p. 153), is the best menstruum for butternut extract. This is of a dark or reddish-brown color, a caramel-like odor, and a bitterish, somewhat astringent taste. In preparing the extract, the bark of the root should be collected between April and July, and used while fresh. It is used chiefly as a gentle cathartic, acting upon the bowels without disposing them to subsequent constipation. The dose is from 10 to 30 grains.

EXTRACTUM JUGLANDIS FLUIDUM (N. F.)—FLUID EXTRACT OF JUGLANS.

Preparation.—*Formulary number*, 163: "From the inner bark of the root of *Juglans cinerea*, Linné (*Butternut*). *Process A* (see F. 135). No. 40 powder. *Menstruum:* Diluted alcohol"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Juglans*). Dose, 10 to 60 minims.

EXTRACTUM JUNIPERI FLUIDUM (N. F.)—FLUID EXTRACT OF JUNIPER.

Preparation.—*Formulary number*, 164: "From the fruit of *Juniperus communis*, Linné (*Juniper*). *Process A* (see F. 135). No. 10 powder. *Menstruum:* Diluted alcohol"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Juniperus*). Dose, 5 to 60 minims.

EXTRACTUM KRAMERIÆ (U. S. P.)—EXTRACT OF KRAMERIA.

SYNONYN: *Extract of rhatany.*

Preparation.—"Krameria, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; water, a sufficient quantity. Moisten the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, pack it in a conical glass percolator, and gradually pour water upon it, until the infusion passes but slightly imbued with the astringency of the krameria. Heat the liquid to the boiling point, strain, and evaporate the strained liquid, by means of a water-bath, at a temperature not exceeding 70° C. (158° F.), to dryness"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—Good extract of rhatany is of a dark-red color, somewhat glossy, non-hygroscopic, faintly odorous, powerfully astringent, and almost wholly dissolved by water. Its evaporation should be performed quickly (or else in vacuo), as the atmosphere speedily oxidizes its active principles, impairing them, and rendering them more or less insoluble. The bark of the root furnishes the greatest amount of extract, and that prepared with water is superior to that made with alcohol. For some purposes a soft extract is prepared by stopping the evaporation at the proper time. Much of the extract of rhatany found in commerce is of an inferior quality. It does not keep well, becoming brittle and hard by age, even in close containers. Extract of rhatany may be used whenever an astringent is required; in some cases it will be found preferable to any other agent of this class. The soft extract may be advantageously used as a local application to *ulcers*, *hemorrhoids*, and *fissures of the anus*. The dose is from 5 to 20 grains, 3 or 4 times a day.

EXTRACTUM KRAMERIÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF KRAMERIA.

SYNONYM: *Fluid extract of rhatany.*

Preparation.—"Krameria, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of diluted alcohol, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterwards diluted alcohol, until the krameria is exhausted. Reserve the first seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Krameria*). A deep brown-red, decidedly astringent fluid. It may be used where the amount of alcohol contained in the tincture is objectionable, and besides, possesses greater astringency than the latter preparation. It is prone to disintegrate, behaving like other red-tannate fluids (see *Fluid Extract of Gossypium*). Dose, 10 to 60 minims.

EXTRACTUM LACTUCARII FLUIDUM (N. F.)—FLUID EXTRACT OF LACTUCARIUM.

Preparation.—*Formulary number*, 166: "Lactucarium, in coarse powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; ether, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; alcohol, water, each, a sufficient quantity. Add the lactucarium to the ether contained in a tared flask having the capacity of six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏], and let it macerate for 24 hours; then add three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, and shake the mixture well. Fit a bent glass tube into the neck of the flask, and, having immersed the flask in hot water, recover the ether by distillation. When all the ether has distilled over, remove the tube, and, after thoroughly shaking the contents of the flask, continue the heat for ½ hour. Let the mixture cool, add one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.] of alcohol, and enough water to make the whole mixture weigh five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; after maceration for 24 hours, with occasional agitation, express and filter the liquid. Return the dregs to the flask and macerate them with two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.] of a mixture of alcohol and water made in the proportion of 1 part of alcohol to 3 parts of water; repeat the maceration 2 or 3 times, successively, with fresh portions of the mixture, until the dregs are tasteless, or nearly so. Mix and filter the liquids thus obtained, and concentrate them, by means of a water-bath (the first expressed liquid by itself), until the combined weight of the liquids is sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; mix the liquids, add forty grammes (40 Gm.) [1 oz., av., 180 grs.] of alcohol, and let the mixture cool in the evaporating vessel, stirring the mixture frequently, and during the intervals keeping the vessel well covered. When cool, add enough alcohol to make the mixture weigh one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; transfer the liquid to a flask, and add enough water to make the mixture measure one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏], using the water so required to rinse the evaporating vessel. Shake the mixture occasionally, during several hours (and frequently, if a portion of the precipitate is found to be tenacious), and, when a uniform mixture results, set it aside for 24 hours, so that any precipitate formed may subside. Decant the clear liquid, transfer the precipitate to a filter, and, after thoroughly draining it into the decanted liquid, wash it with a mixture of alcohol and water made in the proportion of 3 parts of alcohol to 4 parts of water, until the washings pass tasteless. Concentrate the washings, by evaporation, to a syrupy consistence, mix with the decanted liquid, and add enough of the last-named mixture of alcohol and water to make the whole measure one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Lastly, after 24 hours, having meanwhile shaken the fluid extract occasionally, filter it through paper" (*Nat. Form.*).

Medical Uses and Dosage.—(See *Lactucarium*). Dose, 1 to 5 grains.

Related Preparation.—Extractum Lactucæ (*Br.*), *Extract of lettuce, Extractum lactucæ virosæ, Thridacium.* The British official preparation is merely the inspissated juice of *Lactuca virosa.* Feebly hypnotic. Dose, 5 grains.

EXTRACTUM LAPPÆ.—EXTRACT OF LAPPA.

Synonym: *Extract of burdock.*

Preparation.—Exhaust burdock root, coarsely powdered, or in pieces, with water, a sufficient quantity, proceeding in the same manner as explained for the preparation of Aqueous Extracts, on page 758.

Medical Uses and Dosage.—Extract of burdock is principally used as an alterative, in *scrofula*, *syphilis*, *cutaneous affections*, etc. Dose, from 5 to 20 grains, 3 times a day.

EXTRACTUM LAPPÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF LAPPA.

Synonym: *Fluid extract of burdock.*

Preparation.—"Lappa, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the lappa is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Lappa*). A dark brown-red fluid. Dose, ¼ to 2 fluid drachms.

EXTRACTUM LEONURI.—EXTRACT OF LEONURUS.

Synonym: *Extract of motherwort.*

Preparation.—Exhaust the recently dried herb of Leonurus cardiaca, in coarse powder, with alcohol, water, each, a sufficient quantity, proceeding in the same manner as explained for the preparation of Alcoholic Extracts, on page 758 (**J. King**).

Medical Uses and Dosage.—Extract of motherwort is emmenagogue, nervine, and antispasmodic, and may be used with advantage in all forms of disease in which the cold infusion of the herb is recommended. The dose is from 3 to 6 grains, every 2 or 4 hours. It may be advantageously combined with the extracts of asclepias, black cohosh, nerve root, cramp bark, scullcap, etc.

EXTRACTUM LEPTANDRÆ (U. S. P.)—EXTRACT OF LEPTANDRA.

Preparation.—"Leptandra, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity. Mix seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the leptandra is exhausted. Distill off the alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, to a pilular consistence"—(*U. S. P.*).

Description and History.—This is a blackish-brown extract, partially dissolving in water, a deep-brown, bitter solution resulting. (For remarks concerning *Leptandrin* and *Extract of Leptandra*, see *Leptandra*).

Medical Uses and Dosage.—Extract of leptandra is a powerful cholagogue, with but slight laxative influence; except given in very large doses its cathartic powers are but very feeble. It is one of the most efficient and important agents among those of American origin, being the only known medicine that efficiently stimulates and corrects the hepatic secretions and functional derangements of the liver, without debilitating the system by copious alvine evacuations. It may be safely and efficiently employed in the treatment of *diarrhœa*, *cholera infantum*, some forms of *dyspepsia*, *typhoid fever*, and all diseases connected with biliary derangements. Combined with resin of podophyllum it is a prompt and effectual remedy in *epidemic dysentery*, often effecting a permanent cure in from 12 to 18 hours; in dysentery, with irritable bowels, it may be used alone with advantage, or combined with camphor, as in such cases its union with resin of podophyllum is contraindicated. In *intermittents* it renders the action of quinine, when united with it, more certain, and prevents the liability to a return of the disease, at least for the season, and is likewise highly beneficial in *infantile remittent fever*, and in periodic diseases generally, of an obstinate character, in which quinine alone seems to produce little or no result. It may also be used in many other combinations with much advantage, as with hydrochlorate of berberine, or dried ox-gall, in some *dyspeptic affections*, *jaundice*, *piles*, etc., or with oleoresin of blue flag, extract of wild indigo, extract of poke, extract of turkey corn, resin of blue cohosh, and other active principles, in various forms of disease. Dose of extract of leptandra, from ½ to 5, 6, or 7 grains, every 3 or 4 hours, according to the action or effect desired. Some practitioners neglect the use of this agent, because it does not act so powerfully as resin of podophyllum, and hence lose the influence of a very important remedy in functional derangements of the liver, and other organs essential to digestion. The above remarks refer to both the ordinary extract and the dried extract, heretofore known as "Leptandrin" (King). In relation to the dried extract (leptandrin) Prof. Hill observes, and which observations will apply with equal force to the ordinary extract:

"This is not, strictly speaking, a cathartic. It is aperient, alterative, and tonic. Its effects on the liver are peculiar. In cases of children afflicted with *summer complaint*, where there is evidently a lack of the proper biliary secretion, but where, owing to the already irritated condition of the bowels, the ordinary medicines for arousing the liver are inadmissible, this article seems to be the very thing needed While it acts freely upon the liver, instead of purging, it seems only to change the discharges from the light and watery or slimy condition, to a darker and apparently bilious state, rendering them more and more consistent, until they become perfectly natural, without having been arrested entirely, or at any time aggravated. It at the same time seems to act as a tonic, restoring the tone of the stomach and increasing the strength and activity of digestion. It is a most valuable remedy in *dyspepsia*.

"The dose is from ¼ to 1 grain every 1 or 2 hours in acute cases, and from 1 to 2 grains, 3 times a day, in chronic cases. It is valuable to combine with resin of podophyllum as a remedy in *dyspepsia* and *chronic hepatitis*.

"In the *epidemic dysentery*, which has prevailed for the past two seasons in many parts of our country, this article has been of great service. It was usually given with the best success after evacuating the bowels freely, with a combination of resin of podophyllum and dried extract of leptandra or rhubarb. (I have omitted the old incorrect names of *leptandrin* and *podophyllin*, in the original, and substituted the correct ones [King]). For this purpose, give from ½ to 1 grain every hour, gradually lengthening the intervals as the discharges become darker. Though it may not be applicable in all cases of dysentery, it is doubtless one of the most useful articles in this dangerous disease."

In *cholera infantum*, a disease which sometimes sets at defiance all the skill of the physician, Prof. King met with excellent success with the following combination: Take of dried extract of leptandra, 6 grains; quinine, 3 grains; camphor, 1½ grains; ipecacuanha, ¾ grain. Mix and divide into 12 powders of which 1 may be given every 2 or 3 hours, and its use continued thus for several days. Its action at first is to increase the alvine passages and apparently augment the disease, but in a few days the character of the evacuations changes, they become more and more normal, as well as more regular in their appearance; after which, 1 or 2 powders per day for a week, will render the cure permanent. This powder, in large doses for adults, will be found very efficient in painful *diarrhœa* and *dysentery*, as well as in severe pains depending upon *intestinal irritation*. The following has also been of advantage in *cholera infantum:* Triturate together, charcoal 1 drachm, with dried extract of leptandra 3 grains, and divide into 12 powders, of which 1 powder is to be given every 2 or 3 hours until the evacuations become more natural, after which, give 1 or 2 powders a day for a few days.

Extract of leptandra will be found to act with more certainty when it is given in a soluble form, as in tincture, weak solution of potassa, etc. Like hydrochlorate of berberine, and other concentrated preparations which are insoluble in water, it frequently passes through the alimentary canal unchanged, when given in the form of powder.

EXTRACTUM LEPTANDRÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF LEPTANDRA.

Preparation.—"Leptandra, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it moderately in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before until the leptandra is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Leptandra*). This is a dark, reddish-brown, very bitter fluid. It is laxative, cholagogue, and tonic, and may be advantageously substituted for the root in all cases. The dose is from 10 to 60 minims, 1, 2, or 3 times a day. As a laxative, it is preferable to the extract, when dried.

EXTRACTUM LOBELIÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF LOBELIA.

Preparation.—"Lobelia, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the lobelia is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This is a dark greenish-brown fluid exhibiting the acrid and nauseating properties of lobelia. It may be used wherever lobelia is indicated. The dose is from 5 minims to 1 fluid drachm, according to the effect required, and which are equivalent to 5 grains to 1 drachm of the powder.

EXTRACTUM LOBELIÆ FLUIDUM COMPOSITUM.—COMPOUND FLUID EXTRACT OF LOBELIA.

Preparation.—Take of recently dried bloodroot, skunk-cabbage root, and lobelia seed and leaves, each, coarsely powdered, 4 troy ounces; alcohol, diluted alcohol, each, a sufficient quantity. Moisten the powders mixed together, with sufficient alcohol, and let them stand for 24 hours; then transfer the mixture to a percolator, and gradually add alcohol, returning a little of the first that passes, until it runs clear. Reserve, by itself, of the first or strongest percolate, 12 fluid ounces; then pour diluted alcohol on the residuum in the percolator, until the liquid that comes through has very little of the color or taste of the medicine; evaporate this latter solution to 4 fluid ounces by a heat considerably below the boiling point, and while warm mix in the reserved tincture, and make 1 pint of fluid extract.

Medical Uses and Dosage.—This fluid extract is emetic, expectorant, and antispasmodic, and may be used as a substitute for the acetated tincture of bloodroot; A fluid drachm of the extract is equivalent to about 1 drachm of the powder; the dose is from 10 to 60 minims, according to the desired effect (E. S. Wayne).

EXTRACTUM LUPULINI.—EXTRACT OF LUPULIN.

Preparation.—Take of commercial lupulin, 4 ounces; alcohol, 8 fluid ounces. Place the lupulin loosely in a percolator, cover with alcohol, and allow it to stand an hour. Then gradually add alcohol until 2 pints of filtered liquor are obtained, or the drug is practically exhausted. Distill or evaporate off the alcohol, reducing the residue to the consistence of a soft extract. The above extract contains the medicinal principles of the lupulin unimpaired, is of uniform strength, and is in a form convenient for pills. Commercial lupulin yields about 40 grains of extract to 1 drachm of the grains.

Medical Uses and Dosage.—(See *Lupulinum*). This extract possesses the active properties of the hops in an eminent degree, and may be used in all cases where lupulin is admissible. The dose is from 2 to 10 grains, 3 times a day.

EXTRACTUM LUPULINI FLUIDUM (U. S. P.)—FLUID EXTRACT OF LUPULIN.

Preparation.—"Lupulin, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the lupulin with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of alcohol, and pack it firmly in a cylindrical percolator. Then add enough alcohol to saturate the lupulin and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol, until the lupulin is exhausted. Reserve the first seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Lupulinum*). A dark reddish-brown fluid, possessing the taste and odor of hops. Owing to its resinous nature, it can not be mixed with aqueous preparations without the presence of some emulsifying medium. Robbins suggests that lupulin be packed unmoistened to avoid the formation of a mass which is percolated with difficulty. This fluid extract may be used wherever lupulin is indicated; 1 fluid drachm is equivalent to 1 drachm of lupulin, so the dose can be readily proportioned. It may be advantageously combined, at times, with fluid extract of scutellaria, wild cherry. or valerian, etc.

EXTRACTUM MALTI.—EXTRACT OF MALT.

Preparation.—Take of fresh barley malt any desired amount, water, a sufficient quantity; heat the water to a temperature of from 37.7° to 65.5° C. (100° to 150° F.), and moisten the malt with a portion of it. Pack the moistened malt loosely, in a cylindrical percolator of suitable size, and then add more of the water, at the same temperature, until the percolate appears at the exit. Now close the exit with a cork, and allow the whole to macerate, in a warm place, for from 3 to 6 hours. At the expiration of this time, open the exit, and allow the percolation to proceed, adding fresh supplies of heated water, until the percolate has yielded, in weight, an amount equal to twice that of the malt employed. Lastly, evaporate at a temperature ranging from 80° to 94° C. (about 180° to 200° F.), with constant stirring to the consistence of a soft extract. The only full-strength, diastase-bearing extract of malt is made by means of a vacuum apparatus.

Description.—In the preceding process, if the operation of the percolation be neglected, or if the percolate be allowed to stand a short time previous to evaporation, fermentation will speedily ensue, and the resulting extract will have an acid, disagreeable taste. If the temperature be permitted to rise above the boiling point of water after the extract has become somewhat concentrated, a burnt flavor will be imparted to it. The diastase is destroyed at a less temperature. Extract of malt is a translucent, reddish-brown, adhesive substance, of an agreeable, somewhat sweetish, but not positively saccharine taste. An infusion of pure malt has the correct flavor peculiar to fresh malt, and evaporation does not appreciably increase its sweetness; therefore, should any extract of malt have a decidedly syrup-like taste, it may be suspected that some sweetish substance has been added to it, either to overcome the effects of fermentation or to increase the consistence of the extract without the proper evaporation. Glucose appears to be peculiarly adapted for these purposes, and, if the fermentation be not excessive, the addition of this substance will accomplish both objects. This is, probably the only adulterant that will be found.

Medical Uses and Dosage.—This article was introduced into this country from Germany, where it had been used for some time as a tonic and nutrient in *anorexia*, *chronic bronchitis*, *phthisis*, *asthma*, *dyspepsia*, convalescence from exhausting maladies, and in all diseases accompanied by general debility, and impairment of the vital powers; its beneficial effects in these diseases appear to be due to the diastase and the nutritive principles entering into its composition. It forms an excellent substitute for malt liquors in those cases where even a gentle stimulant is contraindicated. At the present time our manufacturers have thrown many malt preparations upon the market into which iron, cod-liver oil, pepsin, quinine, iodides, etc., enter, and apparently without regard to the compatibilities or incompatibilities of the articles thus thrown together; and it is doubtful whether such mixtures exert as beneficial results in the diseases for which they are recommended, as would ensue were the drugs taken separately and alternately, with the malt extract. The dose of extract of malt is from 1 to 4 fluid drachms in milk, or in soup, repeating it 3 times a day.

Related Preparations.—MALTINE. This is a specialty of the Maltine Manufacturing Company of New York City. It is recommended as a palatable, stable and uniform extract of malt of high diastatic power, differing from other malt extracts in containing in addition to the virtues of malted barley the nutritive principles of wheat and oats.

Maltine Plain, is used extensively as a digestant, nutrient, adjunct infant food, galactagogue, and vehicle. The following maltine preparations are also in common use: (1) *Maltine with Cod-liver Oil*; (2) *Maltine with Pepsin and Pancreatin*; (3) *Maltine with Hypophosphites*—lime, soda, iron; (4) *Malto-Yerbine*, containing active principles of *Yerba Santa*; (5) *Maltine Ferrated*—iron pyrophosphate; (6) *Maltine with Phosphate of Iron, Quinin and Strychnin*; (7) *Maltine with Peptones*—beef; (8) *Maltine with Wine of Pepsin*; (9) *Maltine with Coca Wine*; (10) *Maltine with Cascara Sagrada*.

EXTRACTUM MALTI COMPOSITUM.—COMPOUND EXTRACT OF MALT.

SYNONYM: *Extract of malt and hops.*

Preparation.—To 1 part of fresh hops, ground, add 9 parts of malt (1 in 10), and make an extract in the same manner as directed for the simple extract of malt. The odor of the hops is not observed in this preparation owing to the subsequent evaporation, but the bitter taste remains quite distinct. There are many mixtures at present upon the market that contain a greater or lesser amount of extract of malt, but it is not in accordance with our purpose to describe them.

Medical Uses and Dosage.—This preparation differs from the preceding only in the presence of hops, which may impart to it a slight hypnotic influence. It may be used in the same cases, and in the same doses, as named for the extract of malt.

EXTRACTUM MALTI FLUIDUM (N. F.)—FLUID EXTRACT OF MALT.

Preparation.—*Formulary number*, 168: "Malt, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity. Reduce the malt to a coarse powder, not finer than No. 20. Moisten it with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of a mixture of 1 volume of alcohol and 3 volumes of water, and set it aside well covered, until it has ceased to swell. Then mix it with as much of the menstruum as it will take up without dripping, pack it uniformly, but without pressure, in a percolator, and add enough of the before-mentioned menstruum to cover it. When the liquid begins to drop from the orifice, close the latter, and allow the contents to macerate during 24 hours, adding from time to time more menstruum, if necessary, to keep the malt just covered. Then remove the cork and allow the percolation to proceed until the percolate weighs seven hundred and fifty grammes (750 Gm.) [1 lb. av., 10 ozs., 199 grs.]. Set this aside, well corked, until any suspended matters have been deposited. Then decant the clear liquid and preserve it for use. *Note.*—The product thus obtained may be regarded as being practically equivalent to the drug in the proportion of minim for grain, the apparent excess of dissolved matters present in the first portions of the percolate being offset by the soluble matters still remaining in the drug, when the percolation is interrupted"—(*Nat. Form.*).

Description, Medical Uses, and Dosage.—Fluid extract of malt possesses the taste of fresh malt, but is not sweet, and as prepared by the preceding process, will not ferment. It represents in each fluid ounce the soluble principles of 1½ troy ounces of malt. It is a thin, yellow or brownish-yellow liquid. (For uses, see *Maltum.*) The dose varies according to the individual and effects desired (see *Extractum Malti*).

EXTRACTUM MANGIFERÆ FLUIDUM.—FLUID EXTRACT OF MANGIFERA.

Preparation.—Take of the bark of Mangifera indica, in moderately fine powder, 20 troy ounces; of a menstruum of glycerin, 6 fluid ounces; water, 10 fluid ounces (by measure), a sufficient quantity. Add the powder to 64 fluid ounces of the menstruum, in a suitable vessel, and let it macerate for 24 hours, with occasional stirring. Then place it in a muslin strainer, and express; filter the expressed liquid through paper. Return the material within the muslin strainer to the vessel, add 32 fluid ounces of water, and allow this to macerate for 24 hours, when it must be expressed and filtered, as at first. Mix the two filtrates, and, by means of a water-bath, evaporate until the fluid is reduced to 13 fluid ounces, when 3 fluid ounces of alcohol is to be added. Mangifera indica is one of the most difficult substances we have ever attempted to extract by percolation, providing the menstruum is adapted to take up the tannates, with which the bark abounds. In such a case, the menstruum will seldom penetrate beyond an inch or so into the powder, even if it is very coarse; therefore, we prefer and employ maceration.

Description, Medical Uses, and Dosage.—Fluid extract of mangifera is of a dark, ruby-red color when in thin layer, of a peculiar odor, and a sweetish (glycerin), and very astringent taste. This preparation was introduced to the medical profession by Dr. M. F. Linquist, of New Haven, Conn. (For uses, see *Mangifera.*) Dose, 15 to 60 minims.

EXTRACTUM MATICO FLUIDUM (U. S. P.)—FLUID EXTRACT OF MATICO.

Preparation.—"Matico, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and, having moistened the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the matico is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Matico*). This preparation well represents the virtues of matico, although in our opinion a better representative results when alcohol alone is employed, instead of a mixture of alcohol and water. It is of a greenish-black color as made by the official process, of a green color when made with alcohol only. Dose, 20 minims to 2 fluid drachms.

EXTRACTUM MENISPERMI FLUIDUM (U. S. P.)—FLUID EXTRACT OF MENISPERMUM.

SYNONYMS: *Fluid extract of yellow parilla, Fluid extract of Canadian moonseed.*

Preparation.—"Menispermum, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs , 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the menispermum is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Menispermum*). This is an unpleasantly bitter, dark, reddish-brown liquid. Dose, 15 to 60 minims.

EXTRACTUM MEZEREI FLUIDUM (U. S. P.)—FLUID EXTRACT OF MEZEREUM.

Preparation.—"Mezereum, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol, until the mezereum is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate. Distill off the alcohol from the remainder by means of a water-bath, and evaporate the residue, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description and Medical Uses.—This is an acrid green liquid, used chiefly to maintain a discharge from blistered parts. It is used in the preparation of *Linimentum Sinapis Compositum*. The *British Pharmacopœia* directs an ethereal extract of mezereum used in the *compound liniment of mustard* (see below). It is scarcely used at all in America.

Related Preparations.—EXTRACTUM MEZEREI ÆTHEREUM (*Br.*), *Ethereal extract of mezereum.*—This is prepared essentially as follows: Prepare a strong alcoholic tincture of mezereum bark, and distill until a mass of the consistence of a soft extract is left behind; agitate with ether, decant the ethereal solution, distill off the ether, and convert the residue into a soft extract of the consistence of honey.

EXTRACTUM MEZEREI FLUIDUM (*N. F., U. S. P.*, 1880), *Fluid extract of mezereum.*—*Formulary number*, 170: "From the bark of *Daphne Mezereum*, Linné, and of other species of *Daphne* (*Mezereum*). *Process* A (see F. 135). No. 30 powder. *Menstruum:* Alcohol"—(*Nat. Form.*).

EXTRACTUM MITCHELLÆ.—EXTRACT OF MITCHELLA.

SYNONYM: *Extract of partridge berry.*

Preparation.—Exhaust the recently dried herb, Mitchella repens, in coarse powder, with alcohol, water, each, a sufficient quantity, proceeding in the same manner as explained for the preparation of Alcoholic Extracts, on page 758.

Medical Uses and Dosage.—(See *Mitchella*). This extract is an invaluable preparation, and possesses the active medicinal virtues of the plant. It is employed more especially on account of its tonic influence upon the uterus; and in diseases of this organ it may be usefully combined with extracts or resins of black cohosh, or caulophyllum, or extract of aletris, oleoresin of senecio, etc. The dose is from 1 to 10 grains, 3 times a day (J. King).

EXTRACTUM MYRICÆ.—EXTRACT OF MYRICA.

SYNONYMS: *Extract of bayberry bark, Myricin.*

Preparation.—Make a saturated tincture of bayberry bark, filter, distill off a portion of the alcohol, and evaporate the remainder by means of a water-bath, until the mass is of an extractive consistence. The profession is indebted to the late Dr. F. D. Hill, of this city, for first preparing and introducing this article. The term *myricin*, sometimes affixed to a dried extract of bayberry, is thus disposed of by Dr. King: "It is much to be regretted that so many of our active medicinal preparations have recived names which justly belong to pure chemical principles, notwithstanding such names were given from no improper motives. It is absolutely necessary that we drop these misnomers for others more in accordance with the characters of the preparations, and the sooner this is done, the sooner will we be relieved of the charge of empiricism in these matters."

Medical Uses and Dosage.—This extract is a stimulant and astringent, and will be found a very advantageous remedy in *chronic diarrhœa* and *dysentery*, in dysentery with typhoid symptoms, and in *colliquative diarrhœa of phthisis;* in *scarlatina* it may be given with advantage, while a decoction of the bark is employed as a gargle; it will likewise be found a useful remedy for *aphthous affections*, when given internally, and applied locally. It forms an efficient application to *tender, spongy, bleeding gums*, and an excellent snuff for *polypus*, also for *headache* and *catarrhal affections.* It is likewise beneficial in *jaundice*, and in combination with extracts of leptandra and apocynum, I have successfully treated several cases of this affection. In some instances of *cholera*, it will be serviceable, given in combination with extract of geranium. Combined with extract of leptandra, resin of podophyllum, or some other cathartic, it may be employed with benefit in the latter stages of *typhoid fever.* Dose, from 2 to 10 grains of the powder, which may be repeated as often as required (King).

EXTRACTUM NUCIS VOMICÆ (U. S. P.)—EXTRACT OF NUX VOMICA.

Preparation.—"Nux vomica, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; acetic acid, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; alcohol, water, ether, sugar of milk, recently dried and in fine powder, each, a sufficient quantity. Mix alcohol and water in the proportion of seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol to two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water. Mix the powder with one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of the mixture, to which the acetic acid had previously been added, and let it macerate, in a well-covered vessel, in a warm place, during 48 hours. Then pack it tightly in a cylindrical glass percolator; gradually pour menstruum upon it, and continue the percolation until the nux vomica is practically exhausted. Distill off the alcohol by means of a water-bath, transfer the remainder to a tared capsule, and evaporate it until it weighs about one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]. Transfer it to a bottle of the capacity of about five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏], and wash the capsule with about fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏] of warm water, adding the washings to the bottle and mixing the contents thoroughly. When the liquid extract is cold, add to it ¼ of its volume of ether, stopper the bottle, and bring the extract and ether into intimate contact by gently agitating and frequently inverting the bottle, avoiding violent shaking so as to prevent the formation of an emulsion. Pour off the ethereal layer as closely as possible, and repeat this treatment with ether several times, until a few drops of the ethereal layer no longer impart a permanent, greasy stain to filtering paper. Then transfer the contents of the bottle back to the tared capsule, using a sufficient quantity of warm water for washing. Recover the ether from the united ethereal washings, add to the oily residue about fifteen cubic centimeters (15 Cc.) [243 ♏] of boiling water, and then acetic acid, in drops, until the mixture has a permanent acid reaction. Then filter it through a moistened filter, and wash the filter with a little water. Add the filtrate to the extract in the capsule, evaporate until the residue weighs about two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.], and allow it to become cold. Then determine its weight exactly, remove four grammes (4 Gm.) [62 grs.] of the mass, and assay this by the process given below, using the amounts of liquids there directed for two grammes (2 Gm.) [31 grs.] of dry extract. In another portion of five grammes (5 Gm.) [77 grs.] determine the amount of water by drying it, in a flat-bottomed capsule, at 100° C. (212° F.), until it ceases to lose weight. From the results thus obtained ascertain, by calculation, the amount of total alkaloids and of water contained in the remainder of the mass, add to this enough well-dried sugar of milk to bring the quantity of alkaloids in the final dry extract to 15 per cent, then evaporate the mass to complete dryness, reduce it to powder, and transfer it to small, well-stoppered bottles"—(*U. S. P.*).

ASSAY (*U. S. P.*)—"Extract of nux vomica, when assayed by the following process, should be found to contain 15 per cent of total alkaloids.

Assay of Extract of Nux Vomica.—"Extract of nux vomica, dried at 100° C. (212° F.), two grammes (2 Gm.), alcohol, ammonia water, water, chloroform, decinormal sulphuric acid (V.S.), centinormal potassium hydrate V.S., each, a sufficient quantity. Put 2 Gm. of the dried extract of nux vomica into a glass separator, add to it 20 Cc. of a previously prepared mixture of 2 volumes of alcohol, 1 volume of ammonia water (specific gravity 0.960), and 1 volume of water, and shake the well-stoppered separator until the extract is dissolved. Then add 20 Cc. of chloroform and agitate during 5 minutes. Allow the chloroform to separate, remove it as far as possible, pour into the separator a few cubic centimeters of chloroform, and, without shaking, draw this off through the stop-cock to wash the outlet tube. Repeat the extraction with 2 further portions of chloroform of 15 Cc. each, and wash the outlet tube each time as just directed. Collect all the chloroformic solutions in a wide beaker, expose the latter to a gentle heat, on a water-bath, until the chloroform and ammonia are completely dissipated, add to the residue 10 Cc. of decinormal sulphuric acid, measured with great care from a burette, stir gently, and then add 20 Cc. of hot water. When solution has taken place, add 2 Cc. of brazil wood T.S., and then carefully run in centinormal potassium hydrate V.S., until a permanent pinkish color is produced by the action of a slight excess of alkali upon the brazil wood indicator. Divide the number of cubic centimeters of centinormal potassium V.S. used by 10, subtract the number found from 10 (the 10 Cc. of decinormal acid used), multiply the remainder by 0.0364 and that product by 50 (or, multiply at once by 1.82), which will give the percentage of total alkaloids in the extract of nux vomica, it being assumed that strychnine and brucine are present in equal proportion, and the above factor being found by taking the mean of their respective molecular weights rounded off to whole numbers ($[334+394]\div 2=364$)"—(*U. S. P.*).

A study of the foregoing formula for making the extract, shows that the use of ether is simply that of a fat remover. In our opinion, gasoline, or even benzin is its equal and is cheaper.

Extract of nux vomica, as now made by the official process, has a light color, owing to the presence of much milk sugar.

Description, Medical Uses, and Dosage.—(See *Nux Vomica*). This is an intensely bitter, yellow-brown extract, of a somewhat variable percentage of strychnine, but usually about 6 per cent. Of total alkaloids the official demand is 15 per cent. It is used chiefly in pills. This extract contains the powerful properties of nux vomica, but necessarily varies in strength, as above stated, on account of the want of a uniform quantity of strychnine in the seeds. It may be employed in cases where the action of this agent is required. It is very useful in cases of *obstinate constipation*, and may be employed in the following combination: Take extract of butternut, 2 grains; resin of podophyllum, $\frac{1}{16}$ grain; and extract of nux vomica, ¼ of a grain; mix thoroughly together and form a pill, which is a dose, and may be repeated 2 or 3 times daily, or until the desired effect is produced. The dose of the above extract of nux vomica is from ¼ to 2 grains, repeated 2 or 3 times a day, and carefully watching its effects. The small dose of the drug permits of a lower alkaloidal standard, and the interest of manufacturers should be considered whenever possible.

EXTRACTUM NUCIS VOMICÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF NUX VOMICA.

Preparation.—"Nux vomica, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; acetic acid, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; alcohol, water, each, a sufficient quantity. Mix alcohol and water in the proportion of seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol and two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water. Moisten the powder with one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of the mixture, to which the acetic acid had previously been added, and let it digest, in a well-covered vessel, in a warm place, during 48 hours. Then pack it in a cylindrical glass percolator, and gradually pour menstruum upon it, until the nux vomica is practically exhausted. Distill off the alcohol by means of a water-bath, transfer the remainder to a tared capsule, evaporate it until it weighs about two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.], and allow it to become cold. Then determine the weight exactly, remove four grammes (4 Gm.) [62 grs.] of the mass, and assay this by the process given under extract of nux vomica (see *Extractum Nucis Vomicæ*), using the amounts of liquids there directed for two grammes (2 Gm.) [31 grs.] of dry extract. From the results thus obtained ascertain, by calculation, the amount of total alkaloids in the remainder of the mass, and then add to the latter, first, three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of alcohol, and afterward a sufficient quantity of a mixture of 3 volumes of alcohol and 1 volume of water, so that each one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of the finished fluid extract shall contain one and five-tenths grammes (1.5 Gm.) [23 grs.] of total alkaloids"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Nux Vomica*). This liquid is about one-tenth as strong as the extract of nux vomica. A fluid extract comparing with this one may be made by dissolving the proper amount of the solid extract in an hydro-alcoholic menstruum, one-fourth part of which is water. Dose, ¼ to 3 minims.

EXTRACTUM OPII (U. S. P.)—EXTRACT OF OPIUM.

Preparation.—"Powdered opium, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; sugar of milk, recently dried and in fine powder, water, each, a sufficient quantity. Triturate the powdered opium in a mortar thoroughly with one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of water, repeat the trituration occasionally, in the course of 12 hours, then filter through a rapidly-acting, double filter, and wash the filter and residue with water, until the filtrate is nearly colorless. Concentrate the filtrate and washings in a tared capsule, on a water-bath, until the residue weighs about two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.], and allow it to become cold. Then determine the weight exactly, transfer twelve grammes (12 Gm.) [185 grs.] of it to an Erlenmeyer flask, having a capacity of about one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏], and determine in this portion the amount of morphine by the process of assay given below, using the quantities of liquids there directed for four grammes (4 Gm.) [62 grs.] of the dry extract. In another portion of five grammes (5 Gm.) [77 grs.] determine the amount of water by drying it in a flat-bottomed capsule, at 100° C. (212° F.), until it ceases to lose weight. From the results thus obtained ascertain, by calculation, the amount of morphine and of water contained in the remainder of the extract, add to this enough well-dried sugar of milk to bring the quantity of morphine in the final dry extract to 18 per cent, then evaporate the whole to dryness, reduce it to powder, and transfer it to small, well-stoppered vials"—(*U. S. P.*).

Assay (*U. S. P.*), *Assay of Extract of Opium.*—"Extract of opium, dried at 100° C. (212° F.), four grammes (4 Gm.); ammonia water, two and two-tenths cubic centimeters (2.2 Cc.); alcohol, ether, water, each, a sufficient quantity. Dissolve the extract of opium in 30 Cc. of water, filter the solution through a small filter, and wash the filter and residue with water, until all soluble matters are extracted, collecting the washings separately. Evaporate in a tared capsule, first, the washings to a small volume, then add the first filtrate, and evaporate the whole to a weight of 10 Gm. Rotate the concentrated solution about in the capsule until the rings of extract are redissolved, pour the liquid into a tared Erlenmeyer flask having a capacity of about 100 Cc., and rinse the capsule with a few drops of water at a time, until the entire solution weighs 15 Gm. Then add 7 Gm. (or 8.5 Cc) of alcohol, shake well, add 20 Cc. of ether, and shake again. Now add the ammonia water from a graduated pipette or burette, stopper the flask with a sound cork, shake it thoroughly during 10 minutes, and then set it aside, in a moderately cool place, for at least 6 hours, or over night.

"Remove the stopper carefully, and, should any crystals adhere to it, brush them into the flask. Place in a small funnel 2 rapidly-acting filters of a diameter of 7 Cm., plainly folded, one within the other (the triple fold of the inner filter being laid against the single side of the outer filter), wet them well with ether, and decant the ethereal solution as completely as possible upon the inner filter. Add 10 Cc. of ether to the contents of the flask, rotate it, and again decant the ethereal layer upon the inner filter. Repeat this operation with another portion of 10 Cc. of ether. Then pour into the filter the liquid in the flask, in portions, in such a way as to transfer the greater portion of the crystals to the filter, and, when this has passed through, transfer the remaining crystals to the filter by washing the flask with several portions of water, using not more than about 10 Cc. in all. Allow the double filter to drain, then apply water to the crystals, drop by drop, until they are practically free from mother-water, and afterwards wash them, drop by drop, from a pipette, with alcohol previously saturated with powdered morphine. When this has passed through, displace the remaining alcohol by ether, using about 10 Cc., or more, if necessary. Allow the filter to dry in a moderately warm place at a temperature not exceeding 60° C. (140° F.), until its weight remains constant, then carefully transfer the crystals to a tared watch-glass and weigh them. The weight found, multiplied by 25, represents the amount of crystallized morphine obtained from 100 Gm. of the extract"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Opium*). This is essentially a purified extract, the inert matter having been removed in its preparation. It has been found that many persons who can not take the crude drug without experiencing many unpleasant symptoms, can take the extract without its being followed by any of these symptoms. The dose is $\frac{1}{4}$ to $\frac{1}{2}$ grain. The extract may be combined with other extracts, and may, if desired, be dissolved in water.

EXTRACTUM OPII LIQUIDUM.—LIQUID EXTRACT OF OPIUM.

Preparation.—The *British Pharmacopœia* directs the preparation of this fluid extract of opium as follows: "Take of extract of opium 1 ounce (av.), distilled water 16 fluid ounces, rectified spirit 4 fluid ounces. Macerate the extract of opium in the water for an hour, stirring frequently; then add the spirit and filter. The product should measure 1 pint (Imp). It contains 22 grains of extract of opium, nearly, in 1 fluid ounce. Sp. gr., from 0.985 to 0.995"—(*Br. Ph.*). In point of non-nauseating qualities this preparation is superior to other liquid preparations of opium, except the deodorized tincture of opium. This preparation contains those principles of opium soluble in water, and is preserved by the presence of the alcohol, which proportion, according to some pharmacists, should be somewhat increased to give it greater stability.

Medical Uses and Dosage.—Uses, same as *Opium*. Dose, 10 to 30 minims.

EXTRACTUM PAPAVERIS.—EXTRACT OF POPPY.

Preparation.—"Take of poppy capsules, freed from the seeds, and in No. 20 powder, 1 pound (av.); rectified spirit, 2 ounces (Imp.); boiling distilled water, a sufficiency. Mix the poppy capsules with 2 pints of the water, and infuse for 24 hours, stirring frequently, then pack in a percolator, and, adding more of the water, allow the liquor slowly to pass until about a gallon has been collected, or until the residue is exhausted. Evaporate the liquor by a water-bath until it is reduced to a pint, and, when cold, add the spirit. Let the mixture stand for 24 hours, then separate the clear liquor by filtration, and evaporate this by a water-bath until the extract has acquired a suitable consistence for forming pills"—(*Br. Pharm.*). This preparation is seldom employed in America.

Medical Uses and Dosage.—(See *Papaveris Capsulæ*). Dose, 2 to 5 grains.

EXTRACTUM PAREIRÆ.—EXTRACT OF PAREIRA.

Preparation.—"Take of pareira root, in No. 40 powder 1 pound (av.), boiling distilled water, a sufficiency. Digest the pareira root with a pint of the water for 24 hours, then pack in a percolator, and, adding more of the water, allow the liquor slowly to pass until about a gallon has been collected, or the pareira is exhausted. Evaporate the liquor by a water-bath until the extract has acquired a suitable consistence for pills"—(*Br. Ph.*).

Medical Uses and Dosage.—(See *Pareira*). A diluted alcoholic menstruum will, in our opinion, make a better preparation, and one freer from inert matter. Dose, 10 to 30 grains.

EXTRACTUM PAREIRÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF PAREIRA.

Preparation.—"Pareira, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with seven hundred and twenty cubic centimeters (720 Cc.) [24 fl℥, 66 ♏] of alcohol, and one hundred and eighty cubic centimeters (180 Cc.) [6 fl℥, 42 ♏] of water, and having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward a mixture of alcohol and water, made in the proportion of four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of alcohol, to one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of water, until the pareira is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate. Distill off the alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Pareira*). This is a brown, bitter fluid. A weaker alcoholic menstruum is said to produce as efficient a product. We question the usefulness of the glycerin. Dose, 15 to 90 minims, largely diluted.

EXTRACTUM PETROSELINI RADICIS FLUIDUM (N. F.)—FLUID EXTRACT OF PARSLEY ROOT

Preparation.—*Formulary number*, 171: "From the root of *Petroselinum sativum*, Hoffmann (*Parsley*). *Process A* (see F. 135). No. 40 powder. *Menstruum:* Diluted alcohol"—(*Nat. Form.*). Commercial parsley root is prone to injury by insects. Care should be exercised in the selection of the drug, and market-ground parsley root should be excluded if the whole root is to be had.

Medical Uses and Dosage.—(See *Petroselinum*). Dose, 10 to 60 minims.

EXTRACTUM PHYSOSTIGMATIS (U. S. P.)—EXTRACT OF PHYSOSTIGMA.

SYNONYM: *Extract of calabar bean.*

Preparation.—"Physostigma, in No. 80 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol until three thousand cubic centimeters (3000 Cc.) [101 fl℥, 212 ♏] of tincture are obtained, or the physostigma is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; mix this with the reserved portion, and evaporate, at or below the before-mentioned temperature, on a water-bath, to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Physostigma*). In the preparation of this extract, the menstruum directed in the official process should be strictly adhered to. Diluted alcohol produces a greater yield of extract, but at its alkaloidal expense. Extract of physostigma well represents calabar bean, and is of a green-brown color. Dose, $\frac{1}{16}$ to $\frac{1}{5}$ grain.

EXTRACTUM PHYTOLACCÆ.—EXTRACT OF POKE.

Preparation.—Exhaust the recently dried leaves of poke, in coarse powder, with diluted alcohol, a sufficient quantity, proceeding in the same manner as explained for the preparation of Alcoholic Extracts, on page 758. Extract of poke prepared in this manner, is superior to that prepared in the ordinary way with water. The leaves employed in the preparation of the extract should be gathered immediately previous to the ripening of the berries, at which period they are the most active. An extract is prepared from the poke-root in the same manner. An extract formed by evaporating the expressed juice of the recent ripe berries is frequently employed, and has been recently highly lauded as an antifat.

Medical Uses and Dosage.—These various extracts of poke are emetic and purgative in large doses; in medicinal doses they are alterative, and are especially useful in *syphilitic*, *mercurio-syphilitic*, and *rheumatic diseases*, and particularly in the *osteocopic pains of mercurio-syphilis*. They lose their virtues by age, and should be freshly prepared every year. The dose is from 1 to 5 grains, or more, 3 times a day. The inspissated juice of poke-berries (*Succus inspissatus phytolaccæ baccæ*), is frequently employed as a valuable agent in *rheumatism;* it is milder than the extract prepared from the root or leaves. The dose, both as an antifat and in rheumatism, is from 2 to 5 grains 3 times daily. Since, so far as we know, all advertised antifat remedies are given by specialists in connection with heavy doses of cathartics, the inference is that the *cathartic* deserves the credit for the loss of flesh.

EXTRACTUM PHYTOLACCÆ RADICIS FLUIDUM (U. S. P.)

FLUID EXTRACT OF PHYTOLACCA ROOT.

SYNONYM: *Fluid extract of poke-root.*

Preparation.—"Phytolacca root, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder, and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before until the phytolacca root is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏︎]"—(*U. S. P.*).

Medical Uses and Dosage.—As poke-root is of little value unless fresh, it is very probable that this preparation will be of little value in therapy. Dose, from 5 to 10 minims, 3 or 4 times a day.

EXTRACTUM PILOCARPI FLUIDUM (U. S. P.)—FLUID EXTRACT OF PILOCARPUS.

SYNONYM: *Fluid extract of jaborandi.*

Preparation.—"Pilocarpus, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏︎]. Moisten the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏︎] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the pilocarpus is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏︎] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏︎]"—(*U. S. P.*).

In our experience, a preparation to be preferred when its keeping qualities are considered, is made with official alcohol only as the menstruum. We therefore introduce the following process from our Supplement, 1881:

EXTRACTUM PILOCARPI PENNATIFOLII FLUIDUM, *Fluid extract of Pilocarpus pennatifolius, Fluid extract of jaborandi.*—Take of jaborandi leaves, in very fine powder, 16 troy ounces; of alcohol and acetic acid, each, a sufficient quantity. Moisten the powdered leaves with a mixture of 6 fluid ounces of alcohol and 2 fluid drachms of acetic acid. Cork tightly in a wide-mouth bottle, and permit the mixture to stand an hour in a warm situation. Then introduce it into a cylindrical percolator 3 inches in diameter, previously prepared for percolation, according to directions given on page 756, and press very firmly. Cover the surface of the powder with a circular piece of filtering paper, held in position with a few fragments of glass or marble, and add alcohol until the percolate appears at the exit. Then cork the exit tightly; cover the percolator, and place it in a warm situation. After 24 hours loosen the cork, and permit the percolate to pass as fast as it will drop without running in a stream, until 4 fluid ounces are obtained. Again close the exit macerate 24 hours, and, in a manner like unto the preceding, draw 4 fluid ounces of percolate. Repeat the maceration, and, in like manner, draw a third portion of 4 fluid ounces. Reserve and mix the three percolates; then continue the percolation until 8 fluid ounces are obtained. Evaporate this latter portion until reduced to the measure of 2 fluid ounces, and mix with the reserved 12 fluid ounces. The surface of the powder must be constantly covered with alcohol from the commencement, and until the end of the process of percolation.

Description, Medical Uses, and Dosage.—(See *Pilocarpus*). Fluid extract of jaborandi, when prepared with alcohol and acetic acid, is dark-green in color, almost odorless, possesses the taste of the drug, and, as thus prepared, represents very nearly the quality of the drug employed, troy ounce to each fluid ounce of the finished extract. If the fluid extract be made as in the official process, with mixtures of water and alcohol, the dark-colored extractive matters of the leaves are dissolved, and the extract will have a dark reddish-brown color, is more given to precipitation, but will not be as satisfactory as though made with alcohol, either from a pharmaceutical or a therapeutical point of view. The addition of the acetic acid favors the extraction of the pilocarpine, and by using it in connection with alcohol, both the volatile oil and alkaloid of the drug are dissolved. Dose, 1 to 15 minims.

EXTRACTUM PIPERIS METHYSTICI FLUIDUM.—FLUID EXTRACT OF PIPER METHYSTICUM.

Preparation.—Take of the root of Piper methysticum, in moderately fine powder, 16 troy ounces; of a menstruum of alcohol, 3 parts, water, 2 parts (by measure), a sufficient quantity. Moisten the powdered root with 6 fluid ounces of the menstruum. Cork tightly in a wide-mouth bottle, and permit the mixture to stand an hour in a warm situation. Then introduce it into a cylindrical percolator, 3 inches in diameter, previously prepared for percolation according to directions given on page 756, and press moderately. Cover the surface of the powder with a circular piece of filtering paper, held in position with a few fragments of glass or marble, and add fresh menstruum until the percolate appears at the exit. Then cork the exit tightly; cover the percolator, and place it in a warm situation. After 24 hours, loosen the cork, and permit the percolate to pass as fast as it will drop, without running in a stream, until 4 fluid ounces are obtained. Again close the exit, macerate 24 hours, and, in a manner like unto the preceding, draw 4 fluid ounces of percolate. Repeat the maceration, and, in like manner, draw a third portion of 4 fluid ounces. Reserve and mix the 3 percolates; then continue the percolation until 8 fluid ounces are obtained. Evaporate this latter portion until reduced to the measure of 2 fluid ounces, and mix with the reserved 12 fluid ounces. The surface of the powder must be constantly covered with menstruum from the commencement, and until the end of the process of percolation.

Description, Medical Uses, and Dosage.—(See *Piper methysticum*). Fluid extract of Piper methysticum is of a reddish-brown color, and imparts the taste of the root. It is odorless, and, as thus prepared, represents very nearly the quality of drug employed, troy ounce to each fluid ounce of the finished extract. This is our formula, introduced in the Supplement in 1881. The *National Formulary* practically directs the above menstruum and process.

EXTRACTUM PLANTAGINIS CORDATÆ.—EXTRACT OF PLANTAGO CORDATA.

SYNONYM: *Extract of water plantain.*

Preparation.—Exhaust the recently dried root of water plantain, in coarse powder, with alcohol, water, each, a sufficient quantity, proceeding in the same manner as explained for the preparation of *Extractum Hydrastis.*

Medical Uses and Dosage.—Hydro-alcoholic extract of water plantain is astringent, and has been used with much success in *Asiatic cholera*, *diarrhœa*, and *dysentery.* The dose is from 1 to 10 grains, repeated every 1, 2, or 3 hours, as the urgency of the case requires (Wm. S. Merrell).

EXTRACTUM PODOPHYLLI (U. S. P.)—EXTRACT OF PODOPHYLLUM.

SYNONYMS: *Extract of mandrake, Extract of May apple.*

Preparation.—"Podophyllum, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity. Mix eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of alcohol with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of water, and, having moistened the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the podophyllum is exhausted. Distill off the alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This is a dark-brown extract. As an alterative, this may be given in doses of from ½ to 2 or 3 grains; as a purgative, from 3 to 12 grains. It may be used as a substitute for jalap in all cases where a purgative is required. Although not so active as an extract made with official alcohol, it is more useful.

EXTRACTUM PODOPHYLLI FLUIDUM (U. S. P.)—FLUID EXTRACT OF PODOPHYLLUM.

SYNONYMS: *Fluid extract of May apple, Fluid extract of mandrake.*

Preparation.—"Podophyllum, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏︎]. Mix eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏︎] of alcohol with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏︎] of water, and, having moistened the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏︎] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the podophyllum is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏︎] of the percolate. Distill off the alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏︎]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This is a deep brownish-red fluid. It is not much valued in therapy. Dose, 5 to 20 minims.

EXTRACTUM POLYGONI.—EXTRACT OF POLYGONUM.

SYNONYM: *Extract of water pepper.*

Preparation.—Exhaust the recently dried herb of water pepper, in coarse powder, with water, a sufficient quantity, proceeding in the manner explained for the preparation of Aqueous Extracts, on page 758.

Medical Uses and Dosage.—Extract of water pepper is stimulant, diuretic, and emmenagogue, and is especially useful in *amenorrhœa* and *chronic affections of the kidneys.* It is devoid of the pepper taste of fresh water pepper, which constituent is too evanescent to withstand such manipulation. The dose is from 2 to 10 grains, 3 or 4 times a day.

EXTRACTUM POLYGONI FLUIDUM.—FLUID EXTRACT OF POLYGONUM.

SYNONYM: *Fluid extract of water pepper.*

Preparation.—Take of the recently dried leaves of water pepper, in coarse powder, 16 troy ounces; alcohol, diluted alcohol, each, a sufficient quantity. Moisten the leaves thoroughly with alcohol, and let them stand for 24 hours; then transfer them to a percolator, and gradually add alcohol, returning a little of the first that comes through, till it passes clear. Reserve, by itself, of the first percolate, 12 fluid ounces; then gradually add a sufficient quantity of diluted alcohol to the residuum in the percolator, until the liquid that comes through has very little of the color or taste of the water pepper. Evaporate this latter solution to 4 fluid ounces, and, while warm, mix in the reserved tincture, and make 1 pint of fluid extract.

Medical Uses and Dosage.—Fluid extract of water pepper possesses the properties of the dry herb, and may be given whenever that drug is indicated. It is especially useful in *uterine diseases.* The dose is from 10 to 60 minims, 3 or 4 times a day.

EXTRACTUM POLYMNIÆ FLUIDUM.—FLUID EXTRACT OF POLYMNIA.

SYNONYMS: *Fluid extract of uvedalia, Fluid extract of bear's foot.*

Preparation.—Take of the root of Polymnia uvedalia, in moderately fine powder, 16 troy ounces; alcohol, a sufficient quantity. Moisten the powder with 6 fluid ounces of alcohol. Cork tightly in a wide-mouth bottle, and permit the mixture to stand an hour in a warm situation. Then introduce it into a cylindrical percolator, 3 inches in diameter, previously prepared for percolation, according to directions given on page 756, and press very firmly. Cover the surface of the powder with a circular piece of filtering paper, held in position with a few fragments of glass or marble, and add alcohol until the percolate appears at the exit. Then cork the exit tightly, cover the percolator, and place it in a warm situation. After 24 hours, loosen the cork, and permit the percolate to pass as fast as it will drop, without running in a stream, until 4 fluid ounces are obtained. Again close the exit, macerate 24 hours, and, in a manner like unto the preceding, draw 4 fluid ounces of percolate. Repeat the maceration, and, in like manner, draw a third portion of 4 fluid ounces. Reserve and mix the 3 percolates; then continue the percolation until 8 fluid ounces are obtained. Evaporate this latter portion until reduced to the measure of 2 fluid ounces, and mix with the reserved 12 fluid ounces. The surface of the powder must be constantly covered with alcohol from the commencement, and until the end of the process of percolation.

Description, Medical Uses, and Dosage.—Fluid extract of Polymnia uvedalia is reddish-brown in color, of a disagreeable fetid odor and taste, and, as thus prepared, represents very nearly the quality of the drug employed, troy ounce to each fluid ounce of the finished extract. Any addition of water or glycerin to the alcohol composing the menstruum, is to be avoided, as they occasion loss of resinous constituents. (For uses, see *Polymnia*). Dose, 10 to 60 minims.

EXTRACTUM PRUNI VIRGINIANÆ.—EXTRACT OF WILD CHERRY.

Preparation.—Take of wild cherry bark, in coarse powder, alcohol, a sufficient quantity. Moisten the bark with a pint of alcohol, let it stand 24 hours, then transfer to a displacement apparatus, and gradually add alcohol until it passes off nearly tasteless. Evaporate by a gentle heat, or spontaneously; too great a degree of heat will spoil the extract. Wild cherry bark yields to alcohol 22 per cent of dry, deep-red, bitter, astringent extract, containing amygdalin.

Medical Uses and Dosage.—It has been suggested that this extract may be rendered available for extemporaneous prescriptions in the following manner, so as to get the sedative power of the bark associated with all its tonic qualities, thus: Take of alcoholic extract of wild cherry bark, 2 drachms; emulsion of sweet almonds, ½ pint; triturate the extract with a portion of the emulsion till dissolved, and then add the remainder and mix. It should not be used for several hours after it is prepared. The dose is a tablespoonful, and it may be sweetened with sugar or syrup. Before administration it must be shaken, as the coagulum formed by the tannin of the extract acting on the albumen of the emulsion is not to be removed (W. Procter, Jr.).

EXTRACTUM PRUNI VIRGINIANÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF WILD CHERRY.

Preparation.—"Wild cherry, in No. 20 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏︎]; alcohol, water, each a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏︎]. Mix the glycerin with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏︎] of water, and, having moistened the powder with the mixture, pack it firmly in a cylindrical glass percolator, and, having closely covered the percolator, macerate for 48 hours; then gradually add menstruum, made in the proportion of eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of alcohol to one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of water, and allow the percolation to proceed until the wild cherry is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Prunus Virginiana*). This preparation has been the subject of constant change of formula in each succeeding Pharmacopœia. The present formula is thought to be an improvement upon all of its predecessors. However, barring its troublesome manipulation, the modified formula of Prof. W. Procter, Jr., has been considered by competent judges an excellent preparation. Procter's process will be found below. This extract is a dark, wine-red, transparent liquid, not syrupy in consistence, and possessed of a bitter, hydrocyanic taste. If it be desired to make a preparation free from astringency, strips of isinglass, previously softened in water, may be added to the aqueous solution, which will remove the tannic acid.

This may be used wherever wild cherry bark is indicated. One fluid drachm of it represents 30 grains of the bark, 2 fluid ounces of the infusion, or a tablespoonful of the syrup. Four fluid ounces of this fluid extract may be added to 12 fluid ounces of simple syrup to form a syrup of wild cherry bark. Dose, 10 to 60 minims.

Procter's Formula.—FLUID EXTRACT OF WILD CHERRY. Take of wild cherry bark, 24 troy ounces; sweet almonds, 3 troy ounces; pure granulated sugar, 36 troy ounces; alcohol, 88 per cent, and water, each, a sufficient quantity. Macerate the powdered bark in 2 pints of alcohol for 8 hours, introduce it into a percolator and pour on alcohol till 5 pints have passed, observing to regulate the passage of the liquid by a cork or stop-cock. Introduce the tincture into a capsule (or distillatory apparatus, if the alcohol is to be regained), and evaporate it to a syrupy consistence; add ½ pint of water, and again evaporate till the alcohol is entirely removed. Beat the almonds, without blanching, into a smooth paste with a little of the water, and then add sufficient to make the emulsion measure 1½ pints, and pour it in a quart bottle previously containing the solution of the extract of the bark, cork it securely, and agitate occasionally for 24 hours, so as to give time for the decomposition of the amygdalin. The mixture is then to be quickly expressed and filtered into a bottle containing the sugar, marked to hold 3 pints. Water should be added to the dregs, and they again expressed till sufficient filtered liquid is obtained to make the fluid extract measure 3 pints (W. Procter, Jr.). A superior fluid extract of wild cherry, may be made by freely moistening the coarse powdered bark, 16 troy ounces, and sweet almonds, beaten to a paste with just enough water, 1½ troy ounces, with a mixture of equal parts of glycerin and water; cover and let them macerate for 4 days; pack uniformly in a percolator, and gradually add of the mixture of equal parts of glycerin and water, until 11 fluid ounces have been used altogether. Then gradually add alcohol until enough has passed to make the whole amount of fluid extract equal to 1 pint. It will be seen that this process is a modification of the formula of Prof. Procter, the advantage being that the manipulation is more simple. The dose of these extracts is that of the official preparation.

EXTRACTUM PTELEÆ.—EXTRACT OF PTELEA.

SYNONYM: *Alcoholic extract of shrubby trefoil.*

Preparation.—Exhaust the recently dried bark of the root of Ptelea trifoliata, in coarse powder, with alcohol, proceeding in the manner explained for the preparation of Alcoholic Extracts, on page 758.

Medical Uses and Dosage.—This extract is an elegant preparation, and may be used in all cases where ptelea is indicated. The addition of water to the alcohol injures the preparation. The dose is from 2 to 10 grains.

EXTRACTUM QUASSIÆ (U. S. P.)—EXTRACT OF QUASSIA.

Preparation.—"Quassia, in No. 20 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; water, a sufficient quantity. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of water, pack it firmly in a conical percolator, and gradually pour water upon it until the infusion passes but slightly imbued with bitterness. Reduce the liquid to ¾ of its bulk by boiling, and strain; then evaporate, by means of a water-bath, to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This is a concentrated, deep-brown or black, bitter extract, becoming dry and crumbling with age. Dose, usually with other bitter tonics, 1 to 2 grains.

EXTRACTUM QUASSIÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF QUASSIA.

Preparation.—"Quassia, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of alcohol with six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the quassia is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Quassia*). This is a brownish-yellow, persistently bitter fluid. The dose is from 5 to 20 minims, well diluted with water.

EXTRACTUM QUILLAJÆ FLUIDUM (N. F.)—FLUID EXTRACT OF QUILLAJA.

Preparation.—*Formulary number*, 172: "From the bark of *Quillaja Saponaria*, Molina (*Soap bark*). *Process A* (see F. 135). No. 40 powder. *Menstruum:* Diluted alcohol"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Quillaja*). This preparation is used mainly to produce froth in beverages. A few drops will make soda syrups foam liberally. Dose, 1 to 20 minims.

EXTRACTUM RHAMNI PURSHIANÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF RHAMNUS PURSHIANA.

SYNONYM: *Fluid extract of cascara sagrada.*

Preparation.—"Rhamnus purshiana, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the rhamnus purshiana is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—Fluid extract of Rhamnus purshiana is dark yellowish-red in color, almost odorless, of a disagreeable bitter taste, and, as thus prepared, represents very nearly the quality of drug employed, troy ounce to each fluid ounce of the finished extract. This preparation, now made official for the first time, is extensively used as a remedy for *habitual constipation*. It was introduced through the efforts of Parke, Davis & Co., who gave it great conspicuity and liberal advertisements. The drug was first mentioned by Dr. Bundy, but the conspicuity of the fluid extract is clearly to be credited to this energetic firm. Dose, 10 to 45 minims.

EXTRACTUM RHAMNI PURSHIANÆ FLUIDUM AROMATICUM (N. F.)—AROMATIC FLUID EXTRACT OF RHAMNUS PURSHIANA.

SYNONYM: *Aromatic fluid extract of cascara sagrada.*

Preparation.—*Formulary number*, 173: "Rhamnus purshiana, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycyrrhiza, in No. 40 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; calcined magnesia, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; glycerin, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; compound spirit of orange (*U. S. P.*), ten cubic centimeters (10 Cc.) [162 ♏]; alcohol, five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; water, diluted alcohol, (*U. S. P.*), each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the powdered drugs and the magnesia with two thousand cubic centimeters (2000 Cc.) [67 fl℥, 301 ♏] of water, macerate for 12 hours and then dry the mixture on a water-bath at a gentle heat. Mix the glycerin and the alcohol with two hundred and fifty cubic centimeters (250 Cc) [8 fl℥, 218 ♏] of water, and percolate the dried powders with this menstruum, followed by diluted alcohol, according to the directions given under *Process B* (see F. 135). Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] that pass, and set this aside. Continue the percolation with diluted alcohol to practical exhaustion, evaporate this second portion to a soft extract, dissolve it in the reserved portion, and add the compound spirit of orange and sufficient diluted alcohol to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of fluid extract"—(*Nat. Form.*).

Medical Uses and Dosage.—An agreeable aromatic laxative. Dose, 10 to 45 minims.

Under the name of *Cascara Cordial*, Parke, Davis & Co. have long made a palatable preparation of cascara, which enjoys the confidence of those who use it. *Kasagra*, or *Cascara Aromatica*, is a liquid preparation of cascara sagrada, used extensively by physicians, made by Frederick Stearns & Co., of Detroit. Both these preparations are very pleasant to the taste, being destitute of all bitterness.

EXTRACTUM RHEI (U. S. P)—EXTRACT OF RHUBARB.

Preparation.—"Rhubarb, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity. Mix eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of alcohol with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a conical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the tincture passes nearly tasteless. Reserve the first one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of the percolate, and set it aside in a warm place, until it is reduced by spontaneous evaporation to five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]. Evaporate the remainder of the percolate, in a porcelain vessel, by means of a water-bath, at a temperature not exceeding 70° C. (158° F.), to the consistence of syrup. Mix this with the reserved portion, and continue the evaporation, at or below the before-mentioned temperature, until the mixture is reduced to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Rheum*). Great care is required in the preparation of this extract, as both the tonic and purgative properties of rhubarb are very apt to become deteriorated by the process. Only a gentle heat must be employed. The extract prepared by evaporation in vacuo, will be found decidedly the best; it possesses the odor and taste of the root. Extract of rhubarb, only when well and carefully prepared, possesses virtues similar to the drug itself, and may be given in pill form, or in solution in doses of from 5 grains to ½ drachm.

EXTRACTUM RHEI FLUIDUM (U. S. P.)—FLUID EXTRACT OF RHUBARB.

Preparation.—"Rhubarb, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of alcohol with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a conical percolator; then add enough of menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the rhubarb is exhausted. Reserve the first seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 70° C. (158° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Rheum*). This is a very dark red-brown liquid, possessing the characteristic taste and odor of rhubarb. This product remains fluid for a much longer period than those formerly official, in which sugar, glycerin, etc., were employed. Precipitation is likely to occur by age. This is an efficient preparation, fairly representative of the virtues of the rhubarb, and may be administered in all cases where that drug is admissible. The dose for an adult is from ½ to 1 fluid drachm, which are equivalent to similar quantities of the root. When it is desired to disguise the taste, in cases where stimulants are not contraindicated, 6 or 8 fluid drachms may be added to 8 fluid ounces of the above, of a mixture composed of equal parts of tincture of prickly-ash berries, tincture of ginger, and essence of sassafras.

EXTRACTUM RHOIS AROMATICÆ FLUIDUM.—FLUID EXTRACT OF RHUS AROMATICA.

Preparation.—Take of the bark of the root of Rhus aromatica, in fine powder, 16 troy ounces; alcohol, a sufficient quantity. Moisten the powder with 6 fluid ounces of alcohol. Cork tightly in a wide-mouth bottle, and permit the mixture to stand an hour in a warm situation. Then introduce it into a cylindrical percolator, 3 inches in diameter, previously prepared for percolation according to directions given on page 756, and press very firmly. Cover the surface of the powder with a circular piece of filtering paper, held in position with a few fragments of glass or marble, and add alcohol until the percolate appears at the exit. Then cork the exit tightly; cover the percolator, and place it in a warm situation. After 24 hours, loosen the cork, and permit the percolate to pass as fast as it will drop without running in a stream, until 4 fluid ounces are obtained. Again close the exit, macerate 24 hours, and, in a manner like unto the preceding, draw 4 fluid ounces of percolate. Repeat the maceration, and, in like manner, draw a third portion of 4 fluid ounces. Reserve and mix the three percolates, then continue the percolation until 8 fluid ounces are obtained. Evaporate this latter portion until reduced to the measure of 2 fluid ounces, and mix with the reserved 12 fluid ounces. The surface of the powder must be constantly covered with alcohol from the commencement, and until the end of the process of percolation.

Description, Medical Uses, and Dosage.—Fluid extract of Rhus aromatica is of a brownish color, and possesses the disagreeable, turpentine-like odor and taste of the root. It should not be made with a menstruum containing water or glycerin, as these bodies prevent the resinous constituents of the root from dissolving. As prepared by the foregoing formula, the extract represents very nearly those constituents of the root soluble in alcohol, troy ounce to fluid ounce. For uses, see *Rhus aromatica*. Dose, 5 to 60 minims, in water, glycerin and water, or syrup.

EXTRACTUM RHOIS GLABRÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF RHUS GLABRA.

SYNONYM: *Fluid extract of sumach-berries.*

Preparation.—"Rhus glabra, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of diluted alcohol, and, having moistened the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterwards diluted alcohol, until the rhus glabra is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Rhus glabra*). This agent is of a dark-red color, and has the agreeably acidulous and constringing taste of the berries from which it is prepared. (For *fluid extract of the bark*, see below.) Fluid extract of sumach is tonic, astringent, and antiseptic. It will be found beneficial in *scrofula*, *gonorrhœa*, *diarrhœa*, *dysentery*, and in *mercurial sore mouth* and *salivation*. The dose is from ½ fluid drachm to 1 fluid drachm, 3 times a day.

Related Preparation.—FLUID EXTRACT OF RHUS GLABRA BARK, *Fluid extract of sumach bark*. Take of the recently dried bark of Rhus glabra, in coarse powder, 16 troy ounces; alcohol, diluted alcohol, each, a sufficient quantity. Add sufficient alcohol to the bark to thoroughly moisten it, and let it macerate for 24 hours; then transfer the mixture to a percolator, and gradually add alcohol, returning a little of the first that passes, till it runs clear. Reserve by itself, of the first percolate 12 fluid ounces. Then pour diluted alcohol on the residuum in the percolator, until the liquid that passes has very little of the taste of the sumach; evaporate this latter solution to 4 fluid ounces, and while warm mix in the reserved tincture and extract, and make 1 pint of fluid extract. Used same as the preceding.

EXTRACTUM ROSÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF ROSE.

SYNONYM: *Fluid extract of red rose.*

Preparation.—"Red rose, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of diluted alcohol, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward diluted alcohol, until the red rose is exhausted. Reserve the first seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of the percolate, and evaporate the remainder in a porcelain capsule, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This fluid has a deep-red color, and the odor of rose. To the taste it is pleasantly subastringent. It may be added to mouth washes and gargles, and employed to disguise the taste of magnesium and sodium sulphates, etc. Dose, 30 minims to 2 fluid drachms

EXTRACTUM RUBI FLUIDUM (U. S. P.)—FLUID EXTRACT OF RUBUS.

Synonym: *Fluid extract of blackberry bark.*

Preparation.—"Rubus, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol and three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, and, having moistened the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward a mixture of alcohol and water, made in the proportion of six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol and three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, until the rubus is exhausted. Reserve the first seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏] of the percolate. Distill off the alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough of the mixture of alcohol and water, using the last-named proportions, to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—A strongly astringent, dark red-brown, translucent liquid. Dose, 30 minims to 2 fluid drachms.

EXTRACTUM RUMICIS.—EXTRACT OF RUMEX.

Synonym: *Extract of yellow dock.*

Preparation.—Exhaust coarsely powdered yellow dock root, with alcohol, water, each, a sufficient quantity, proceeding in the manner explained for the preparation of Alcoholic Extracts, on page 758 (E. S. Wayne).

Medical Uses and Dosage.—This extract is tonic and alterative, and is efficient in *scrofula* and *cutaneous diseases*. It is most generally given in combination with some other alterative, as extract of poke, cimicifuga, dulcamara, corydalis, etc. The dose is from 1 to 5 grains, 3 times a day.

EXTRACTUM RUMICIS FLUIDUM (U. S. P.)—FLUID EXTRACT OF RUMEX.

Synonym: *Fluid extract of yellow dock.*

Preparation.—"Rumex, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 oz., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol until the rumex is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Rumex*). This dark reddish-brown fluid has a bitter and astringent taste, and well represents the crude drug. Dose, 10 to 60 minims.

EXTRACTUM SABINÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF SAVINE.

Preparation.—"Savine, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol, until the savine is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder at a temperature not exceeding 50° C. (122° F.) to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Sabina*). This preparation contains the active constituents of savine, and has a dark, brownish-green color. It precipitates when mixed with water. Dose, 2 to 15 minims.

EXTRACTUM SANGUINARIÆ.—EXTRACT OF SANGUINARIA.

SYNONYM: *Extract of bloodroot.*

Preparation.—Exhaust coarsely powdered bloodroot, with alcohol, water, each, a sufficient quantity, proceeding in the manner explained for the preparation of Alcoholic Extracts, on page 758.

Medical Uses and Dosage.—This preparation of bloodroot is expectorant, alterative, and emmenagogue, and may be used with benefit in *pulmonary* and *hepatic diseases*, *jaundice*, and *amenorrhœa*. Externally, it forms a mild caustic, and and may be advantageously applied to *indolent ulcers* and *fistula-in-ano*. It possesses the virtues of the root. The dose is from $\frac{1}{2}$ to 1 grain (J. King).

EXTRACTUM SANGUINARIÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF SANGUINARIA.

SYNONYM: *Fluid extract of bloodroot.*

Preparation.—"Sanguinaria, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lb. av., 3 ozs., 120 grs.]; acetic acid, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the alcohol and water in the proportion of seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol, and two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water. Moisten the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of the mixture, to which the acetic acid had previously been added, and let it macerate, in a well-covered vessel, in a warm place, during 48 hours. Then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until the sanguinaria is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Sanguinaria*). This is a deep-red fluid with the tendency, as with all fluid preparations of bloodroot, to precipitation. The formula is improved, in this regard, by using official alcohol instead of alcohol diluted with water, and that, too, without injuring the drug energy of the product. It well represents the crude drug. Dose, from ½ to 5 minims.

EXTRACTUM SARSAPARILLÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF SARSAPARILLA.

Preparation.—"Sarsaparilla, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥. 391 ♏]. Mix three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of alcohol with six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the sarsaparilla is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This is a somewhat thick, opaque fluid, of a deep red-brown color, and a sweetish and persistent, sub-acrid taste. It is fast losing its popularity as a remedy. Dose, 30 to 60 minims.

EXTRACTUM SARSAPARILLÆ FLUIDUM COMPOSITUM (U. S. P.) COMPOUND FLUID EXTRACT OF SARSAPARILLA.

Preparation.—"Sarsaparilla, in No. 30 powder, seven hundred and fifty grammes (750 Gm.) [1 lb. av., 10 ozs., 199 grs.]; glycyrrhiza, in No. 30 powder, one hundred and twenty grammes (120 Gm.) [4 ozs. av., 102 grs.]; sassafras, in No. 30 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; mezereum, in No. 30 powder, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; alcohol, water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of alcohol and six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of water, and, having moistened the mixed powders with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward a mixture of alcohol and water, made in the proportion of three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of alcohol to six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of water, until the powder is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 259 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough of a mixture of alcohol and water, using the last-named proportions, to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This preparation depends for its virtues chiefly upon the mezereum, and the utility of the latter is even questionable. It is intended to replace the compound decoction of sarsaparilla. Inasmuch as the latter contains guaiacum, an active constituent, in our opinion this compound fluid extract is the less efficient of the two. This fluid extract is reputed alterative, and may be used in *scrofula* and *secondary syphilis.* The dose is a fluid drachm, which is equivalent to a drachm of the root, 3 or 4 times a day.

EXTRACTUM SCILLÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF SQUILL.

Preparation.—"Squill, in No. 20 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and, having moistened the powder with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of the mixture, pack it in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the squill is exhausted. Reserve the first seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Scilla*). This preparation has a deep, clear, brown-red color, and a bitter, acrid taste. Alcohol appears to extract the active constituents, though this is best accomplished by the use of diluted acetic acid. It is also suggested that the fluid extract be prepared half strength (*Amer. Drug.*, 1886, p. 202). Dose, 1 to 5 minims, largely diluted with water.

EXTRACTUM SCOPARII FLUIDUM (U. S. P.)—FLUID EXTRACT OF SCOPARIUS.

SYNONYM: *Fluid extract of broom.*

Preparation.—"Scoparius, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of diluted alcohol, and pack firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, using the same proportions of alcohol and water as before, until the scoparius is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Scoparius*). This is a deep olive-hued liquid of the bitter taste and peculiar odor of broom. An unimportant precipitate may fall. This is intended as a diuretic, but is not so active in this respect as the infusion, and is inferior to that preparation. Dose, 15 to 60 minims.

EXTRACTUM SCUTELLARIÆ.—EXTRACT OF SCUTELLARIA.

Synonym: *Extract of scullcap.*

Preparation.—Exhaust the recent dried herb, scullcap, in powder, with diluted alcohol, a sufficient quantity, proceeding in the manner explained for the preparation of Alcoholic Extracts, on page 758.

Medical Uses and Dosage.—(See *Scutellaria*). Extract of scullcap is tonic, nervine, and antispasmodic. It has been used with advantage in cases of *nervous excitability*, *chorea*, *wakefulness*, and *restlessness;* it may be used alone or in combination with the alcoholic extracts of cimicifuga, cypripedium, or asclepias. The dose is from 1 to 5 grains, 3 or 4 times a day.

EXTRACTUM SCUTELLARIÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF SCUTELLARIA.

Synonym: *Fluid extract of scullcap.*

Preparation.—"Scutellaria, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the scutellaria is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Scutellaria*). This preparation has a dark green-brown color. Diluted alcohol, however, does not produce a very permanent preparation. Fluid extract of sculleap is tonic, nervine, and antispasmodic, and is a very convenient and eligible form of administering the active principles of the plant. It may be used in all cases where the herb is indicated. The dose is from ½ to 1 fluid drachm, 3 or 4 times a day (J. King).

EXTRACTUM SENEGÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF SENEGA

Synonym: *Fluid extract of seneka.*

Preparation.—"Senega, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lb. av., 3 ozs., 120 grs.]; ammonia water, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the ammonia water with seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol and two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of water, and, having moistened the powder with four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and then a mixture of alcohol and water, made in the proportion of seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol to two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, until the senega is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏) of the percolate, and evaporate the remainder, in a porcelain capsule, to a soft extract; dissolve this in the reserved portion, and add enough of the last-mentioned mixture of alcohol and water to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This is a rather thin, deep-brown fluid, having the acrid taste and peculiar odor of senega. Senegin is better extracted by water than by a menstruum strongly alcoholic, though when water is used pectinous matter loads the product so that after a time gelatinization takes place. As a hydro-alcoholic menstruum containing one-third water thoroughly extracts the properties of senega, and with the presence of ammonia to prevent gelatinization, the fluid keeps well, it has been suggested that the official menstruum is unnecessarily too strongly alcoholic. By age, this fluid extract is liable to precipitate a gelatinous substance (pectic acid), which may be redissolved by the cautious addition of a few drops of ammonia water. Fluid extract of senega possesses all the properties of the root, and may be given drachm for drachm, in all cases in which the root is indicated. It may also be added to syrup, honey, and other articles, to form senega syrup, expectorants, etc.

EXTRACTUM SENNÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF SENNA.

Preparation.—"Senna, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol until the senna is exhausted. Reserve the first eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of the percolate, and evaporate the remainder to a soft extract, dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Senna*). In this process, the aromatics and Hoffman's anodyne of former processes are omitted. The earlier preparations were also too thick and gave heavy deposits. Glycerin, added to later processes, did not improve the product, so it is now omitted. When it is desirable to aromatize this fluid extract, add 16 minims of oil of cloves dissolved in ½ fluid ounce of tincture of ginger to the quantity of the formula. If the senna is passed through a sieve 50 or 60 meshes to the inch, and a funnel-shaped percolator be used, the first pint of tincture will contain most of the valuable portion of the senna, and by observing precautions in its evaporation, it is not injured in the process. As the aromatics are omitted, the fluid extract can be employed to make other fluid extracts, tinctures, or syrups, into which senna enters. This forms a neat preparation of senna of a deep-brown color and the characteristic taste and odor of the leaves. An inert precipitate often separates in large amount, and deposits upon the sides and bottom of the container. Dose, 1 to 4 fluid drachms. The purgative dose for an adult is ½ fluid ounce.

EXTRACTUM SENNÆ FLUIDUM DEODORATUM (N. F.) DEODORIZED FLUID EXTRACT OF SENNA.

Preparation.—*Formulary number*, 174: "Senna, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each a sufficient quantity. Moisten the senna with three hundred and fifty cubic centimeters 350 Cc.) [11 fl℥, 400 ♏] of alcohol, pack it firmly in a percolator, and percolate it with alcohol until it is practically exhausted by this menstruum. The alcoholic percolate thus obtained is rejected, and the alcohol may be recovered therefrom by distillation. Then take out the moist powder, dry it, and prepare a fluid extract by the process and menstruum below mentioned: *Process A* (see F. 135), *Menstruum:* Diluted alcohol"—(*Nat. Form.*).

This preparation is intended to carry the laxative qualities of senna without the griping constituents. These are removed by the preliminary percolation by means of alcohol.

Medical Uses and Dosage.—(See *Senna*). Dose, 1 to 2 fluid drachms.

EXTRACTUM SENNÆ ET JALAPÆ FLUIDUM.—FLUID EXTRACT OF SENNA AND JALAP

SYNONYM: *Fluid extract of antibilious physic.*

Preparation.—Take of senna, in coarse powder, 16 troy ounces; jalap root, in coarse powder, 8 troy ounces; alcohol, a sufficient quantity; carbonate of potassium, 6 drachms; white sugar, 8 troy ounces; diluted alcohol, a sufficient quantity; oil of cloves, 40 minims; oil of anise, 20 minims. Mix the senna and jalap together, and add a sufficient quantity of alcohol to thoroughly moisten them, and let the mixture stand for 24 hours; then transfer it to a percolator, and gradually add alcohol, returning a little of the first that passes till it runs clear. Reserve by itself, of the first percolate, 16 fluid ounces. Then add a sufficient quantity of diluted alcohol to the residuum in the percolator, until the liquid passes but very little impregnated with the properties of the medicine; evaporate this latter solution to 4 fluid ounces, then add the sugar, the carbonate of potassium, the oils of cloves and anise, previously dissolved in a little alcohol, also the reserved tincture, and make 1½ pints of the fluid extract.

Medical Uses and Dosage.—This is a concentrated form of the compound powder of jalap, and may be given with safety in all cases where a purgative is required. Should any resinous matter be deposited, it must be dissolved in alcohol and combined with the extract; the addition of the carbonate of potassium is to enable the resinous matter deposited during evaporation, to be dissolved; also to aid in counteracting the griping property of the medicine. The dose for an adult is 1 fluid drachm, which is about equivalent to 1 drachm of the powder (J. King).

EXTRACTUM SENECIONIS FLUIDUM.—FLUID. EXTRACT OF SENECIO.

SYNONYM: *Fluid extract of life-root.*

Preparation.—Take of the recently dried herb Senecio aureus, in coarse powder, 16 troy ounces; alcohol, diluted alcohol, each a sufficient quantity. Add a sufficient quantity of the alcohol to the herb to thoroughly moisten it, and allow the mixture to macerate for 24 hours; then transfer it to a percolator, and gradually add alcohol, returning a little of the first that passes, till it runs clear. Reserve, by itself, of the first percolate, 12 fluid ounces. Then pour gradually on the residuum in the percolator, a sufficient quantity of diluted alcohol, until the liquid that passes is but slightly impregnated with the properties of the life-root herb; evaporate this latter solution to 4 fluid ounces, and while warm mix in the reserved tincture, and make 1 pint of fluid extract.

Medical Uses and Dosage.—(See *Senecio*). This fluid extract possesses the medicinal virtues of the life-root, and forms a useful agent in *amenorrhœa*, either alone or in combination with the fluid extracts of black cohosh, water-pepper, etc. It may likewise be used advantageously in the other diseases in which the root is found efficient. The dose is from ½ to 1 fluid drachm, 3 or 4 times a day (J. King).

EXTRACTUM SERPENTARIÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF SERPENTARIA.

Preparation.—"Serpentaria, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of alcohol with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of water, and, having moistened the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the serpentaria is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Serpentaria*). This is a thin and transparent, deep reddish-brown concentrated tincture, having the bitter taste and characteristic odor of Virginia snake-root. It fully represents the virtues of the drug. This fluid extract forms a useful tonic, which may be used where the root is admissible. The dose is from 15 to 45 minims, 3 or 4 times a day.

EXTRACTUM SPIGELIÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF SPIGELIA.

Preparation.—"Spigelia, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the spigelia is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Spigelia*). This is a deep-brown translucent, concentrated tincture, possessing the taste of the crude drug. In the original process sugar was employed; this was supplanted, in 1870, by 50 per cent of glycerin; at the present time both have been discarded, the preparation having been found to keep well without them. This forms a fluid extract which may be employed in all cases where pink-root is indicated. The dose for an adult is from 2 to 4 fluid drachms; for a child 1 or 2 years of age, from 10 to 30 minims.

EXTRACTUM SPIGELIÆ FLUIDUM COMPOSITUM.—COMPOUND FLUID EXTRACT OF SPIGELIA.

SYNONYM: *Fluid extract of entozoic powder.*

Preparation.—Take of pink-root, swamp milkweed, mandrake, bitter-root, each, in fine powder, 2¾ troy ounces; balmony, in moderately fine powder, 5 troy ounces; alcohol, diluted alcohol, each, a sufficient quantity. Add a sufficient quantity of the alcohol to the powders to thoroughly moisten them, and allow the mixture to macerate for 24 hours; then transfer it to a percolator, and gradually add alcohol until 12 fluid ounces have passed, which set aside. Then gradually add diluted alcohol to the residuum in the percolator, until it is exhausted; evaporate this in a water-bath, to 4 fluid ounces, and, while warm mix in the reserved tincture, and make 1 pint of fluid extract.

Medical Uses and Dosage.—This fluid extract may be used instead of the compound powder of spigelia, in doses of from 5 to 8 drops for a child a year old, or from 10 to 20 drops for an adult, repeating the dose every hour until it acts freely upon the bowels, after which administer the dose 3 times a day, for several days in succession. A very pleasant preparation for worms may be made by adding 1 part of this fluid extract to 12 parts of simple syrup, of which the dose for a child a year old is a teaspoonful, and for an adult a tablespoonful, to be repeated in the same manner as named in the preceding doses. This will answer especially for those children who can not take the entozoic powder (J. King).

EXTRACTUM SPIGELIÆ ET SENNÆ FLUIDUM.—FLUID EXTRACT OF SPIGELIA AND SENNA.

Preparation.—Take of coarsely-powdered pink-root, 16 ounces (av.); senna, in coarse powder, 8 ounces (av.); white sugar, 24 ounces (av.); carbonate of potassium, 1 ounce (av.); oil of caraway, oil of anise, each, ½ drachm; diluted alcohol, a sufficient quantity. Moisten the pink-root and senna with diluted alcohol, and macerate for 48 hours. Then introduce them into a percolator, and gradually add diluted alcohol until 5 pints have passed. Evaporate this in a water-bath to 20 fluid ounces, and add the carbonate of potassium, which prevents any resinous substance from being precipitated, and also modifies the griping action of the senna. Triturate the oils with a portion of the sugar, then with the whole of it, add this to the evaporated liquid, and dissolve the sugar by a gentle heat. The whole should measure 2 pints (W. Procter, Jr.).

This fluid extract may also be prepared by mixing together fluid extract of pink-root, 5 fluid ounces; fluid extract of senna, 3 fluid ounces, dissolving in them carbonate of potassium, 2 drachms, and oils of caraway and anise, each, 10 minims (W. Procter, Jr., *Proc. Amer. Pharm. Assoc.*, 1859, p. 276).

Medical Uses and Dosage.—This fluid extract, which is an elegant preparation, is quite a pleasant medicine, possessing both cathartic and anthelmintic properties. An adult may take half a fluid ounce or an ordinary tablespoonful for a dose; and a child 2 to 4 years old, 1 fluid drachm or a teaspoonful.

EXTRACTUM STERCULIÆ FLUIDUM (N. F.)—FLUID EXTRACT OF STERCULIA.

SYNONYM: *Fluid extract of kola (cola).*

Preparation.—*Formulary number*, 175: "From the seeds of *Sterculia acuminata*, R. Brown (*Cola; Kola*). *Process B* (see F. 135). No. 20 powder. *Menstruum I:* Alcohol, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏︎]; water, six hundred and eighty-five cubic centimeters (685 Cc.) [23 fl℥, 78 ♏︎]; glycerin, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏︎]. *Menstruum II:* Alcohol, 1 volume; water, 3 volumes"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Kola*). This fluid extract does not mix well with water. The dose is from 10 to 30 minims.

EXTRACTUM STILLINGIÆ.—EXTRACT OF STILLINGIA.

SYNONYM: *Extract of queen's-root.*

Preparation.—Exhaust the recent root of stillingia, cut into small pieces, with alcohol, water, each, a sufficient quantity, proceeding in the manner explained for the preparation of Alcoholic Extracts, on page 758.

Medical Uses and Dosage.—(See *Stillingia*). In large doses the extract of stillingia is emetic and cathartic, for which actions it is but little employed in medicine, on account of the nausea, prostration, and burning sensation at the stomach caused by it. In small doses it is a valuable alterative, peculiar to American practice, and may be efficiently used in all diseases requiring alterative remedies. It is usually given in combination with other alteratives, the virtues of which it appears to increase. The compound syrup of stillingia is now more generally used in practice, but this extract will be found useful in cases where pills are preferred to fluid preparations. The dose is 1, 2, or 3 grains, 3 times a day.

EXTRACTUM STILLINGIÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF STILLINGIA.

Preparation.—"Stillingia, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the stillingia is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Stillingia*). A dark reddish-brown liquid, with a bitter and pungent taste. It is apt to gelatinize with age. Employed chiefly in *scrofula*, *syphilis*, and *skin affections*. Dose, 10 to 45 minims.

Related Preparation.—The following is the old formula for *Fluid extract of queen's-root* of this Dispensatory: BRONCHIAL ELIXIR.—Take of the recently gathered root of stillingia, cut into small pieces, 16 troy ounces; white sugar, 8 troy ounces; oil of caraway, 1 fluid drachm; diluted alcohol, a sufficient quantity. Moisten the root with diluted alcohol, and let the mixture stand for 24 hours; then transfer it to a percolator, and continue the percolation with diluted alcohol. Reserve the first 12 fluid ounces. Then pour diluted alcohol on the residuum in the percolator, until the liquid that comes through is but slightly impregnated with the properties of the stillingia; add the sugar, and evaporate by a moderate heat to 4 fluid ounces, then mix in the reserved tincture and the oil of caraway, and make 1 pint of fluid extract. This fluid extract possesses all the active properties of the queen's root, in a concentrated form, 1 fluid drachm being equal to 1 drachm of the root. On account of its great activity it is never used in *scrofula*, *syphilis*, etc., in which the more agreeable and sufficiently active and efficient compound syrup of stillingia is preferred. It has been, however, found very efficient in *bronchitis*, *laryngitis*, and various *pulmonary affections*. The dose is from 2 to 5 or 10 drops, to be placed upon the tongue, and allowed to pass very slowly into the stomach.

EXTRACTUM STILLINGIÆ FLUIDUM COMPOSITUM (N. F.) COMPOUND FLUID EXTRACT OF STILLINGIA.

Preparation.—*Formulary number*, 176: "Stillingia, two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.]; corydalis (root), two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.]; iris, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; sambucus, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; chimaphila, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; coriander, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; xanthoxylum berries, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]. Reduce the drugs to a moderately coarse (No. 40) powder, and prepare a fluid extract in the usual manner by the process and menstrua below mentioned: *Process B* (see F. 135). *Menstruum I:* Alcohol, five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; glycerin, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; water, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]. *Menstruum II:* Diluted alcohol"—(*Nat. Form.*).

Medical Uses and Dosage.—Chiefly employed as an alterative in *scrofula*, *syphilis*, *rheumatism*, and allied disorders. Dose, 10 to 60 minims.

EXTRACTUM STRAMONII SEMINIS (U. S. P.)—EXTRACT OF STRAMONIUM SEED.

SYNONYMS: *Extractum stramonii* (*Pharm.*, 1880), *Extract of stramonium.*

Preparation.—"Stramonium seed, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity.

Moisten the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol until three thousand cubic centimeters (3000 Cc.) [101 fl℥, 212 ♏] of tincture are obtained, or the stramonium seed is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; mix this with the reserved portion, and, by means of a water-bath, evaporate, at or below the before-mentioned temperature, to a pilular consistence"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This preparation is now prepared from the seed instead of the leaves, as in the *U. S. P.*, 1870. Below we give formula for an extract from the leaves, which we have designated *Extractum Stramonii Foliorum.* Extract of stramonium seed is preferable either to an alcoholic or an aqueous extract of the leaves, or their inspissated juice. It is, in large doses, a narcotic poison; in medicinal doses it is anodyne and antispasmodic, and may be administered with benefit in *painful* and *periodic diseases, nervous excitability* or *irritability, gastritis, enteritis, peritonitis, dysmenorrhœa, rigidity of the os uteri*, etc. It may also be applied externally in *rheumatic* and *neuralgic pains*, and to reduce *local inflammations.* The dose is from $\frac{1}{8}$ to $\frac{1}{4}$ grain, 3 times a day.

Related Preparation.—EXTRACTUM STRAMONII FOLIORUM, *Extract of stramonium leaves.* Exhaust recently dried stramonium leaves, in coarse powder, in a percolator with diluted alcohol, a sufficient quantity. (If the diluted alcohol be prepared with a mixture of acetic acid (2 parts), and water (1 part), instead of water alone, it will form a more powerful extract). From the tincture thus made, separate the alcohol, and then carefully evaporate the residue until it is of the required consistence. Be careful not to spoil the extract by too high a temperature while evaporating. When made in large quantity, it should be in vacuo, so that too elevated a temperature may be avoided, and also that the alcohol may be saved (see preparation of Alcoholic Extracts, on page 758).

EXTRACTUM STRAMONII SEMINIS FLUIDUM (U. S. P.)

FLUID EXTRACT OF STRAMONIUM SEED.

SYNONYMS: *Extractum stramonii fluidum* (*Pharm.* 1880), *Fluid extract of stramonium.*

Preparation.—"Stramonium seed, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and, having moistened the powder with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the stramonium seed is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F)., to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Stramonium*). This fluid has a deep-brown color, and, in our opinion, is improved if it be made with official, instead of diluted alcohol. In this case the color will be much lighter and the liquid will be less syrupy. The fixed oil of stramonium has no medicinal value, but nothing is gained by separating it from the drug by preliminary percolation with ether or benzol. Dose, $\frac{1}{4}$ to 2 minims.

EXTRACTUM SUMBUL FLUIDUM.—FLUID EXTRACT OF SUMBUL.

Preparation.—Take of sumbul root, in moderately fine powder, 16 troy ounces; alcohol, a sufficient quantity. Moisten the powder with 6 fluid ounces of alcohol. Cork tightly in a wide-mouth bottle, and permit the mixture to stand an hour in a warm situation. Then introduce it into a cylindrical percolator, 3 inches in diameter, previously prepared for percolation, according to directions given on page 756, and press very firmly. Cover the surface of the powder with a circular piece of filtering paper, held in position with a few fragments of glass or marble, and add alcohol until the percolate appears at the exit. Then cork the exit tightly; cover the percolator, and place it in a warm situation. After 24 hours, loosen the cork, and permit the percolate to pass as fast as it will drop, without running in a stream, until 4 fluid ounces are obtained. Again close the exit, macerate 24 hours, and, in a manner like unto the preceding, draw 4 fluid ounces of percolate. Repeat the maceration, and, in like manner, draw a third portion of 4 fluid ounces. Reserve and mix the three percolates; then continue the percolation until 8 fluid ounces are obtained. Evaporate this latter portion until reduced to the measure of 2 fluid ounces, and mix with the reserved 12 fluid ounces. The surface of the powder must be constantly covered with alcohol from the commencement, and until the end of the process of percolation.

Description, Medical Uses, and Dosage.—Fluid extract of sumbul has a dark reddish-brown color, a disagreeable and acrid taste, and possesses the musk-like odor of the root, and as thus prepared, represents very nearly the quality of drug employed, troy ounce to each fluid ounce of the finished extract. Water or glycerin are detrimental, inasmuch as either will prevent the solution of the resin of the root, and can not, in return, dissolve a single therapeutical constituent known to us, that is insoluble in alcohol. When the fluid extract is made with mixtures of alcohol and water, it is very much darker in color than when alcohol only is employed, but is inferior as a therapeutical agent. (For uses, see *Sumbul*). Dose, 10 to 60 minims.

EXTRACTUM TARAXACI (U. S. P.)—EXTRACT OF TARAXACUM.

SYNONYM: *Extract of dandelion.*

Preparation.—"Taraxacum, freshly gathered in autumn, a convenient quantity; water, a sufficient quantity. Slice the taraxacum, and bruise it in a stone mortar, sprinkling water over it from time to time, until it is reduced to a pulp; then express and strain the juice, and evaporate it in a vacuum apparatus, or in a shallow porcelain dish, by means of a water-bath, to a pilular consistence. Keep the extract in a close vessel, and cover its surface with a cloth, which ought to be moistened occasionally with a little ether or chloroform"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—Dandelion root, for the above purpose, should be collected in September, October, or November. The juice procured by the above method should be evaporated in shallow vessels, by means of steam heat; but the best extract is obtained by evaporation in vacuo. In the process of the *British Pharmacopœia*, the clear liquid obtained by expressing the crushed fresh root is directed to be heated to 100° C. (212° F.), and maintained at that point for 10 minutes. This is a wise provision, as the albumen contained in the juice is thereby coagulated, and may subsequently be removed by straining. In the evaporation of this extract, too much heat or too long an exposure to the air will spoil it. When the extract is good, it is brownish, not blackish, bitter and aromatic, and not sweet. A blackish-sweet extract is more or less impaired. The extract should be renewed annually, as it loses its virtues by age and exposure.

Extract of dandelion is tonic, diuretic, and aperient. It is much recommended in *affections of the liver*, *spleen*, and *kidneys*, in *dropsical diseases*, etc. I have made much use of various preparations of dandelion, and the effects are far from being so decided and beneficial as the testimony of writers led me to suppose; we have several agents vastly superior to it in medicinal efficacy, in the diseases for which it is prescribed. The dose of the extract is from 10 to 60 grains, 3 times a day (J. King).

EXTRACTUM TARAXACI FLUIDUM (U. S. P.)—FLUID EXTRACT OF TARAXACUM.

SYNONYM: *Fluid extract of dandelion.*

Preparation.—"Taraxacum, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of diluted alcohol, and pack it firmly in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding diluted alcohol, until the taraxacum is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate; distill off the alcohol from the remainder by means of a water-bath, and evaporate the residue to a soft extract; dissolve this in the reserved portion, and add enough diluted alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This is a red-brown, bitterish-sweet liquid. Fluid extract of dandelion may be administered in all cases when the influence of this drug upon the system is desired. The dose is 1 or 2 fluid drachms, 3 times a day. Some practitioners speak very highly of the therapeutical influence of dandelion; others, myself among the number, do not (J. King).

EXTRACTUM TRILLII FLUIDUM (N. F.)—FLUID EXTRACT OF TRILLIUM.

Preparation.—*Formulary number*, 177: "From the rhizomes of *Trillium erectum*, Linné, and other species of *Trillium* (*Bethroot*). *Process A* (see F. 135). No. 40 powder. *Menstruum:* Alcohol, 3 volumes; water, 2 volumes"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Trillium*). Dose, 5 to 30 minims.

EXTRACTUM TRITICI FLUIDUM (U. S. P.)—FLUID EXTRACT OF TRITICUM.

SYNONYM: *Fluid extract of couch-grass.*

Preparation.—"Triticum, finely cut, one thousand grammes (1000 Gm.) [2 lbs. av., 3 oz., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Pack the triticum in a cylindrical percolator, pour boiling water upon it, and allow the percolation to proceed, supplying boiling water as required until the triticum is exhausted. Evaporate the percolate to seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏], and, having added to it two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of alcohol, mix well and set it aside for 48 hours. Then filter the liquid and add to the filtrate enough of a mixture of alcohol and water, made in the proportion of 1 volume of alcohol to 3 volumes of water, to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

The *German Pharmacopœia* directs that 1 part of couch-grass be digested for 6 hours in 5 parts of boiling water, filtered, and evaporated to an extractive consistence.

Description, Medical Uses, and Dosage.—(See *Triticum*). This forms a sweet, brown extract. It is employed in some demulcent infusion for its influence upon the mucous tissues of the lungs, bowels, and genito-urinary organs. It is less valuable than the decoction. Dose, 2 to 6 fluid drachms.

EXTRACTUM TURNERÆ FLUIDUM.—FLUID EXTRACT OF TURNERA.

SYNONYM: *Fluid extract of damiana.*

Preparation.—Take of the leaves of damiana, in moderately fine powder, 16 troy ounces; of a menstruum of alcohol, 3 parts, water, 2 parts (by measure), a sufficient quantity. Moisten the powdered leaves with 6 fluid ounces of the menstruum. Cork tightly in a wide-mouth bottle, and permit the mixture to stand an hour in a warm situation. Then introduce it into a cylindrical percolator, 3 inches in diameter, previously prepared for percolation, according to directions given on page 756, and press very firmly. Cover the surface of the powder with a circular piece of filtering paper, held in position with a few fragments of glass or marble, and add fresh menstruum until the percolate appears at the exit. Then cork the exit tightly; cover the percolator, and place it in a warm situation. After 24 hours, loosen the cork, and permit the percolate to pass as fast as it will drop, without running in a stream, until 4 fluid ounces are obtained. Again close the exit, macerate 24 hours, and, in a manner like unto the preceding, draw 4 fluid ounces of percolate. Repeat the maceration, and, in like manner, draw a third portion of 4 fluid ounces. Reserve and mix the 3 percolates; then continue the percolation until 8 fluid ounces are obtained. Evaporate this latter portion until reduced to the measure of 2 fluid ounces, and mix with the reserved 12 fluid ounces. The surface of the powder must be constantly covered with menstruum from the commencement, and until the end of the process of percolation.

Description, Medical Uses, and Dosage.—(See *Damiana*). Fluid extract of damiana has a fragrant, herbaceous, balm-like odor and taste, and, as thus prepared, represents very nearly the quality of the drug employed, troy ounce to each fluid ounce of the finished extract.

EXTRACTUM URTICÆ FLUIDUM (N. F.)—FLUID EXTRACT OF URTICA.

Preparation.—*Formulary number*, 179: "From the root of *Urtica dioica*, Linné (*Nettle*). *Process A* (see F. 135). No. 40 powder. *Menstruum:* Diluted alcohol"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Urtica*). This preparation is liable to disintegration and precipitation, often changing to a gelatinous magma. Dose, 5 to 20 minims.

EXTRACTUM UVÆ URSI (U. S. P.)—EXTRACT OF UVA URSI.

Preparation.—"Uva ursi, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity. Mix two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of alcohol with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before until the uva ursi is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate; evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Mix this with the reserved portion, and evaporate at or below the before-mentioned temperature, on a water-bath, to a pilular consistence"—(*U. S. P.*).

Medical Uses and Dosage.—(See *Uva Ursi*). This extract may be given in capsules in doses of 10 to 60 grains.

EXTRACTUM UVÆ URSI FLUIDUM (U. S. P.)—FLUID EXTRACT OF UVA URSI.

Preparation.—"Uva ursi, in No. 30 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycerin, three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of alcohol and five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water, and, having moistened the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of the mixture, pack it firmly in a cylindrical glass percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator macerate for 48 hours. Then allow the percolation to proceed, gradually adding, first, the remainder of the menstruum, and afterward a mixture of alcohol and water, made in the proportion of two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of alcohol to five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water, until the uva ursi is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough of the mixture of alcohol and water to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Uva Ursi*). This is a deep-brown fluid of a sweet-bitterish and astringent taste. This fluid extract may be used wherever uva ursi is indicated, in doses of a fluid drachm. It has been found very useful in *irritable conditions of the bladder*, associated with 3 to 5 fluid ounces of the fluid extract of lupulin.

EXTRACTUM VALERIANÆ FLUIDUM (U. S. P.)—FLUID EXTRACT OF VALERIAN.

Preparation.—"Valerian, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and, having moistened the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the valerian is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Valerian*). This is a deep reddish-brown fluid, representing valerian root in odor and taste. It holds the virtues of valerian in a concentrated state, and may be used when desired to obtain the influence of that agent. It may also be combined with various other fluid extracts, as of cimicifuga, cypripedium, senecio, etc. The dose is 1 or 2 fluid drachms, 3 times a day, or oftener if required.

EXTRACTUM VANILLÆ FLUIDUM.—FLUID EXTRACT OF VANILLA.

Preparation.—Take of choice vanilla, 1 troy ounce; sugar, 14 troy ounces; deodorized alcohol, 4 fluid ounces; diluted alcohol, water, each, a sufficient quantity. Cut the vanilla in short transverse slices, beat it to a pulp with 2 ounces of sugar and a little alcohol, put the mixture in a small percolator, and pour gradually on, first, the alcohol, and afterward diluted alcohol, till 12 ounces of tincture are obtained. Add 2 ounces of sugar to this tincture, evaporate it at 48.8° C. (120° F.), till reduced to 6 fluid ounces; then add the remainder of the sugar and 5 ounces of water, or as much as is sufficient to make a pint of fluid extract.

Medical Uses and Dosage.—(See *Vanilla*). This extract embodies all the aroma of the beans, and is well adapted for both pharmaceutical and culinary uses. Two fluid ounces added to 2 pints of simple syrup, form an excellent *syrup of vanilla*, or if a perfectly transparent syrup be desired, 2 ounces of the fluid extract may be triturated with 2 drachms of carbonate of magnesium, to which ½ pint of water may be added gradually; then filter, mix the liquid with another ½ pint of water, and add 2½ pounds (troy) of sugar, dissolve with gentle heat, and strain (Wm. Procter, Jr.). In our experience, great care must be exercised in the selection of vanilla. The short beans (vanillons) are not fitted for use other than as tobacco flavors, and seem not to be much, if any, superior to tonka beans for that purpose.

Flavoring Extracts and Essences.—Under the names *Flavoring Extracts and Essences*, mixtures of ethers, solutions of oils, and in some cases tinctures of fruits, are employed in culinary operations and in syrups. These are important as soda water flavors, and chiefly for this purpose do we introduce a few standard extracts of this description, taking the formulæ from "*Elixirs and Flavoring Extracts*," by J. U. Lloyd.

Flavoring Extract of Chocolate.—Powdered chocolate, 4 ounces; syrup, water, of each, a sufficient amount. Rub the chocolate in a mortar, with syrup gradually added, until reduced to a cream, then add syrup enough to bring to the measure of 8 fluid ounces, after which add 1 pint of water. Pour the mixture into a pan and bring it to a brisk boil and then allow to cool. This extract is of uncertain quality, owing to the variation in commercial chocolates. It is never transparent, and is likely to deposit considerable sediment. It will ferment in hot weather, and must either be made in small amounts or put into small bottles that are well filled and kept in a cool place. Some persons flavor extract of chocolate with vanilla, but in our experience it is not always acceptable.

Flavoring Extract of Coffee.—Freshly roasted Java coffee, 8 ounces; alcohol and water mixed in the proportion of alcohol 12, water 4, a sufficient amount. Powder the coffee coarsely, moisten with the mixed alcohol and water, and pack in a previously prepared, suitable percolator. Cover the powder with the menstruum (about 20 ounces), and when the percolate appears, close the exit and allow the coffee to macerate 24 hours; then continue the percolation until 1 pint is obtained. The remarks we have made concerning the quality of chocolate will apply also to coffee. The process we commend produces an extract that represents the coffee very accurately, and in our opinion the addition of syrup and glycerin is undesirable.

Flavoring Extract of Ginger.—Jamaica ginger, freshly powdered, 2 ounces; alcohol a sufficient amount. Pack the powder in a percolator prepared for percolation. Cover with alcohol (using about 20 fluid ounces), and when the percolate appears, close the exit of the percolator, and macerate for a period of 24 hours. Then percolate slowly until 1 pint of the percolate is obtained. The strength may be increased or diminished to suit the taste of the operator, the quality desired governing in this direction. The diluted alcohol may also be replaced with alcohol.

Flavoring Extract of Ginger (*Soluble*).—Fluid extract of ginger (*U. S. P.*), 4 fluid ounces; magnesium carbonate, water, alcohol, of each, a sufficient amount. Evaporate the fluid extract to 1 fluid ounce; add enough magnesium carbonate to form a creamy mixture, then water to bring to the measure of 8 fluid ounces, rubbing well together, and filter. To the filtrate add enough alcohol to make a total of 16 fluid ounces. Color, if desirable, with caramel. Some persons wish a hot, peppery taste; this is made by using a few drops of tincture of capsicum. The operator can determine the necessity for this addition, and modify the extract to suit the whim of his patrons.

Flavoring Extract of Lemon (*Good, from the oil*).—Oil of lemon, 1 fluid ounce; alcohol, 15 fluid ounces. Mix them together, and after a few days, filter if a precipitate forms. Then color to suit the taste with a little tincture of curcuma.

Flavoring Extract of Lemon.—Grate off the outer rind of 4 lemons. Put this into a wide-mouth bottle and pour upon it a pint of alcohol, and add thereto ½ fluid ounce of fresh oil of lemon. Macerate, with occasional shaking, for 4 days, and filter. Color the filtrate to suit the taste with a sufficient amount of tincture of curcuma.

Flavoring Extract of Nectar.—This is one of the fanciful titles that have been given to a soda water syrup that is quite popular. The following formula produces a mixture that gives general satisfaction: Flavoring extracts, of vanilla, 3 fluid ounces; of lemon, 6 fluid ounces; of orange, 4 fluid ounces; of strawberry, 3 fluid ounces. Mix these together, and, if necessary, filter through a little carbonate of magnesium.

Flavoring Extract of Orange (*Good*).—Add 1 fluid ounce of sweet oil of orange to 15 fluid ounces of alcohol, and color the mixture to suit the taste with tincture of curcuma modified with a little cochineal color. The manipulator should bear in mind, in the making of flavoring extract of orange, that the demand is for an extract of a dark-yellow color, whereas, in making an extract of lemon the demand is for an extract of a much lighter color. The various shades can easily be made with different proportions of curcuma tincture and cochineal.

Flavoring Extract of Pineapple.—Extract of pineapple is a favorite with some persons, although most people select one of the preceding flavors. It may be said that the majority prefer lemon, vanilla, and orange, but next, perhaps, to these comes pineapple. Extract of pineapple is not made from the fruit, neither is it made from the oil nor a product of the fruit. It is an association of ether flavors which reminds one of the odor of pineapples. The base of pineapple extract is butyric ether, to which are added other substances to modify its harshness.

Flavoring Extract of Pineapple (*Strong*).—Butyric ether, 2 fluid ounces; diluted alcohol, 14 fluid ounces. Mix them together and flavor to suit the taste with a little tincture of curcuma, and modify with enough cochineal color to overcome the bright yellow of the curcuma.

Flavoring Extract of Raspberry.—That which we have written concerning artificial flavoring extract of strawberry (see below) may be applied to the flavoring extract of raspberry. While some formulæ that we have seen are complex and demand the use of rare ethers, we have not observed that the products more nearly resemble the flavor of fresh raspberries than an extract made of cheaper ingredients. We have not as yet found any mixture that will more than remind us of the rich fragrance of the ripe, red raspberry. Indeed, in the raspberry season the artificial imitations of this fruit are far from being satisfactory, although they may be used when the fruit is out of season. The formula for the extract of strawberry is usually adopted, we believe, as that of extract of raspberry, the difference being that the color is intensified in the raspberry. However, we have found the following process to give satisfaction in a commercial way, and we therefore introduce it as a formula for flavoring extract of raspberry: Fluid extract of orris root, 2 fluid ounces; acetic ether, ½ fluid ounce; oil of cognac, 10 drops; butyric ether, 5 drops; diluted alcohol, 16 fluid ounces. Mix the ingredients, color to a dark red with tincture of cochineal, and after a few days filter, if necessary.

Flavoring Extract of Rose.—Oil of rose, 20 drops; alcohol, 4 fluid ounces; water, 12 fluid ounces; diluted alcohol, 16 fluid ounces. Dissolve the oil of rose in the diluted alcohol, and color with cochineal color to suit the taste.

Flavoring Extract of Sarsaparilla.—Oil of wintergreen, ½ ounce; oil of sassafras, ½ ounce; alcohol, 5 fluid ounces; water, 10 fluid ounces; caramel, a sufficient quantity. Triturate the mixed oils with magnesium carbonate, enough to form a thick cream, then with the mixed alcohol and water, and filter. To the filtrate add enough caramel to color it dark brown. This extract is designed to represent the drug neither in flavor nor in quality, but, upon the contrary, is made up of flavors that have been adopted and affixed to the syrup or beverage sold under the name sarsaparilla, and is foreign altogether to the drug. It is used as a flavor for mineral water beverages and soda syrups, and is a mixture of wintergreen and sassafras, and its connection with sarsaparilla drug is imaginary.

Flavoring Extract of Strawberry.—Fluid extract of orris root, ½ fluid ounce; acetic ether, 1 fluid drachm; oil of cognac, 5 drops; alcohol, 4 fluid ounces; diluted alcohol, 4 fluid ounces; water, 20 fluid ounces; cochineal color, a sufficient quantity. Mix the ingredients well together. Color to a bright strawberry-red with the cochineal color, and, after a few days, filter if necessary. Extracts of strawberry, as is well known, are made from mixtures of ethers, and, while the flavor is pleasant, and often reminds one of strawberry fruit, still we can not say that the artificial flavors with which we are acquainted compare with the odor of the fresh fruit. They will answer for making syrups when the fruit is out of season, or when a true juice of the fruit can not be obtained, but we must say that we do not commend these artificial extracts as being representatives of the fruit itself. The formulæ that we present are such as will produce good trade extracts.

Flavoring Extract of Wintergreen.—Oil of wintergreen, 1 fluid ounce; alcohol, 15 fluid ounces. Mix them together. This extract may be made of fresh berries, but not of the flavor strength produced by the foregoing formula. There is, perhaps, a freshness in the extract that is made of the berries that is wanting in the solution of the oil; but few persons, however, can procure fresh wintergreen berries. In selecting oil of wintergreen, it is to be borne in mind that the commercial oil is likely to be either oil of white birch or synthetical oil.

EXTRACTUM VERATRI VIRIDIS FLUIDUM (U. S. P.)—FLUID EXTRACT OF VERATRUM VIRIDE.

Synonyms: *Fluid extract of American hellebore, Fluid extract of American veratrum.*

Preparation.—"Veratrum viride, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of alcohol, pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol, until the Veratrum viride is exhausted. Reserve the first nine hundred cubic centimeters

(900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Veratrum*). This preparation holds the alkaloids and resins of veratrum in solution, and is about 2½ times stronger than tincture of veratrum. Dose, $\frac{1}{10}$ to 2 minims.

EXTRACTUM VERBASCI FLUIDUM (N. F.)—FLUID EXTRACT OF VERBASCUM.

Preparation.—*Formulary number*, 180: "From the leaves and flowers of *Verbascum Thapsus*, Linné (*Mullein*). *Process A* (see F. 135). No. 20 powder. *Menstruum:* Diluted alcohol"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Verbascum*). Dose, 10 to 60 minims.

EXTRACTUM VERBENÆ FLUIDUM (N. F.)—FLUID EXTRACT OF VERBENA.

Preparation.—*Formulary number*, 181: "From the root of *Verbena hastata*, Linné (*Vervain*). *Process A* (see F. 135). No. 40 powder. *Menstruum:* Diluted alcohol"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Verbena*). Dose, 10 to 60 minims.

EXTRACTUM VIBURNI.—EXTRACT OF VIBURNUM.

SYNONYMS: *Extract of high cranberry bark, Alcoholic extract of cramp-bark, Viburnine.*

Preparation.—Exhaust coarsely-powdered bark of Viburnum opulus, with alcohol, water, of each a sufficient quantity, proceeding in the manner explained for the preparation of Alcoholic Extracts, on page 758.

Medical Uses and Dosage.—(See *Viburnum opulus*). Extract of high cranberry bark is tonic and antispasmodic, and may be used in all cases in which the high cranberry bark is indicated. In *uterine difficulties* it may be advantageously combined with some uterine tonic, as resins of caulophyllum or cimicifuga, oleoresin of senecio, alcoholic extract of aletris, etc. In *bilious* and *flatulent colic*, and *spasmodic pains of the stomach* and *bowels*, it will be found very efficient in combination with extract of dioscorea. The dose of it is from 1 to 10 grains, 3 times a day (J. King).

EXTRACTUM VIBURNI OPULI FLUIDUM (U. S. P.)—FLUID EXTRACT OF VIBURNUM OPULUS.

SYNONYM: *Fluid extract of cramp-bark.*

Preparation.—"Viburnum opulus, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and, having moistened the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of the mixture, pack it moderately in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before, until the Viburnum opulus is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Viburnum*). This is a reddish-brown fluid, having an astringent taste, and practically no odor. It is official for the first time. Dose, ½ to 1 fluid drachm.

EXTRACTUM VIBURNI PRUNIFOLII FLUIDUM (U. S. P.)—FLUID EXTRACT OF VIBURNUM PRUNIFOLIUM.

Synonym: *Fluid extract of black haw bark.*

Preparation.—"Viburnum prunifolium, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and, having moistened the powder with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of the mixture, pack it moderately in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of alcohol and water as before until the Viburnum prunifolium is exhausted. Reserve the first eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—This agent has a deep reddish-brown color and a bitter, astringent taste. Dose, 10 to 60 minims.

EXTRACTUM XANTHOXYLI FLUIDUM (U. S. P.)—FLUID EXTRACT OF XANTHOXYLUM.

Synonym: *Fluid extract of prickly ash.*

Preparation.—"Xanthoxylum, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol, until the xanthoxylum is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Xanthoxylum*). This is a reddish-brown liquid possessing the acrid pungency of the crude drug. Fluid extract of prickly ash bark is a stimulant, tonic, alterative, and sialogogue, and may be used in all cases where the bark is indicated or desired. The dose is from 10 to 60 minims, 3 times a day (J. King.)

EXTRACTUM ZEÆ FLUIDUM (N. F.)—FLUID EXTRACT OF ZEA.

Synonyms: *Extractum stigmatum maydis fluidum, Fluid extract of corn silk.*

Preparation.—*Formulary number*, 182: "From the stigmata of *Zea Mays*, Linné (*Indian corn*). *Process A* (see F. 135). No. 40 powder. *Menstruum:* Diluted alcohol"—(*Nat. Form.*).

Medical Uses and Dosage.—(See *Zea*). Dose, ½ to 2 fluid drachms.

EXTRACTUM ZINGIBERIS FLUIDUM (U. S. P.)—FLUID EXTRACT OF GINGER.

Preparation.—"Ginger, in No. 40 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol until the ginger is exhausted. Reserve the first nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough alcohol to make the fluid extract measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Description, Medical Uses, and Dosage.—(See *Zingiber*). This is a transparent, brownish-red fluid, exhibiting strongly the sensible properties of ginger. Its strength is five-fold that of the tincture. Dose, from 1 to 20 minims.

FABIANA.—FABIANA.

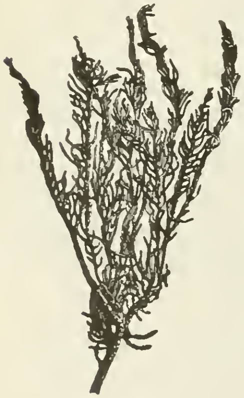
The leaves and branches of *Fabiana imbricata*, Ruiz and Pavon.

Nat. Ord.—Solanaceæ.

Common Name: *Pichi.*

Botanical Source.—Fabiana is a tree-like shrub which grows from 15 to 20 feet high, and has short, thick, bluish-green leaves, which are densely imbricated on the branches. The flowers are single, terminal, white or purplish, and tubular, with the corolla much longer than the calyx. The fruit is a 2-celled, 2-valved capsule, enclosing sub-globular, angular seeds.

Fig. 114.



Fabiana imbricata.

History.—This tree-like shrub grows on the dry, sandy hill-tops of Chili. Though belonging to the solanaceous family, it has, when not in bloom, the general appearance of a conifer. The tender portions of the plant are covered with a peculiar, greenish-gray resin, unaffected by water, and affording protection to the plant by preventing the too rapid evaporation of its moisture. The whole plant has a bluish-green aspect. Its Chilian name is *Pichi*. The drug imparts its virtues to alcohol, the tincture yielding a heavy precipitate when added to water. Pichi was introduced into American commerce by Parke, Davis & Co., of Detroit, Mich.

Description.—The larger branches abound in resin, and are covered with ash-colored bark, finely beset with minute longitudinal, elevated, and minute protruding glands, exhibiting when magnified, a lustrous, resinous appearance. The younger branches or branchlets, are densely covered with the imbricated leaflets, which are scale-like, long, broad-ovate, sessile, entire, glaucous, and of a blue-green hue. The wood is yellow.

Chemical Composition.—The results of chemical analyses of this drug are somewhat at variance with each other. Dr. Rusby, who studied the plant at the place of its growth, believed the bitterness of the drug to be due to an alkaloid contained in its abundant resin. A. B. Lyons succeeded in isolating from an ethereal solution of the drug a small amount (less than 0.1 per cent), of a substance whose acid solution was bitter and gave the usual reactions for alkaloids. The supposed alkaloid was provisionally named *fabianine*. Besides, Mr. Lyons found a neutral, crystallizable, tasteless principle, insoluble in water but soluble in ether; furthermore a fluorescent body closely resembling the glucosid *æsculin*, the characteristic constituent of horse-chestnut; also a volatile oil and a bitter resin in great quantity, soluble in alkalies from which solution it was precipitated by acids; it is not fluorescent, is soluble in ether and chloroform, and sparingly soluble in water and petroleum ether (*Amer. Jour. Pharm.*, 1886, p. 65). The ether-soluble crystalline compound alluded to was analyzed by Prof. Trimble and Mr. Schroeter, and its formula ascertained to be $(C_{18}H_{31}O)_x$. H. C. Loudenbeck (*Amer. Jour. Pharm.*, 1891, p. 434), made a complete analysis of the drug, and obtained the fluorescent principle in crystalline form. It had a bitter taste and yielded an intense blue fluorescence with ammonia water, and a rose-red fluorescence in acid solution. The author doubts the existence of an alkaloid in this drug.

Action, Medical Uses, and Dosage.—Pichi has not been extensively employed by Eclectic practitioners. It is reputed a diuretic, tonic, and hepatic stimulant. It favorably influences digestion, and the hepatic benefit derived from it is believed by many to be the indirect result of its effects upon stomach digestion. *Dyspepsia* and *jaundice* have been treated with it. As a diuretic, it acts similarly to the terebinthinates and balsams, and like them, is of no value in *structural renal disease*, but of benefit only in functional disorders, and particularly those of a catarrhal type. It has been successfully employed in *cystic catarrh*, both acute and chronic, and is said to be a popular remedy in Chili, for both *hepatic* and *urinary calculi*. *Gonorrhœa*, and *prostatitis* accompanying or following that complaint, are said to be benefited by it. Notwithstanding its irritant character (in large doses), and the view held that it is contraindicated in structural kidney disease, benefit has been claimed from its use as an antihemorrhagic in *albuminuria* when bleeding is associated with the latter disorder. An infusion (℥i to water Oij), is given in wineglassful doses every 4 hours; dose of the fluid extract, ½ to 1 fluid drachm every 4 hours, in capsules or flavored emulsion. It precipitates in water unless the latter be alkalinized. In doses of from 5 to 20 drops Prof. Webster speaks well of the fluid extract to relieve *urinary irritation*, *dysuria*, *vesical tenesmus*, and *cystitis*. It is also recommended in *nocturnal urinal incontinence*, *renal congestion* (when no organic changes exist), and in alkalinized solution in the *uric acid diathesis*.

Specific Indications and Uses.—Cystic irritation, dysuria, and vesical tenesmus, all with catarrhal discharge; vesical pain with frequent urination.

FARINA TRITICI.—WHEATEN FLOUR.

The sifted flour of the grain of *Triticum sativum*, Lamarck (*Triticum vulgare*, Villars).

Nat. Ord.—Graminaceæ.

Common Names: *Common flour*, *Wheat flour.*

Illustration (of plant): Bentley and Trimen, *Med. Plants*, 294.

Botanical Source.—This plant, the common winter wheat, described as *Triticum sativum*, var. *hybernum*, has a fibrous root, and a round, smooth, straight stem, 3 to 4 feet or more in height, the internodes being somewhat inflated. The leaves are lance-linear, veined, roughish above, with truncate and bristly stipules. The flowers are borne on a 4-cornered, imbricated, terminal spike, 2 or 3 inches in length, with a tough rachis. The spikelets are crowded, broad-ovate, about 4-flowered; the glumes ventricose, ovate, truncate, mucronate, compressed below the apex, round and convex at the back, with a prominent nervure. The paleæ of the upper florets are somewhat bearded. The grains are loose (W.—L.—Wi.).

History.—Several species of Triticum are cultivated in different countries, among which may be named the *Triticum sativum* (*Triticum vulgare*), the species most generally raised in this country and Europe. It has two varieties, *Triticum æstivum*, or spring wheat, and *Triticum hybernum*, or winter wheat. Linnæus considered these as distinct species, but botanists of the present day generally refer them to one common stock. Barley and oats have the perianth attached to the grain, which is not the case with wheat. Wheat is supposed to be a native of Central Asia, in the country of the Baschkirs. The medicinal part is the seeds, deprived of their husk, and ground to a fine flour. Wheat is subject to ravages from several parasitical fungi, viz.: (1) *Bunt, smut-balls*, or *pepper-brand*, produced by *Uredo Caries*, and giving a disgusting odor to the flour. This fungous plant is also called *Tilletia Caries*, and infests corn grains and other grasses. (2) *Smut, dust-brand*, or *burnt-ear*, produced by *Ustilago segetum* (*Uredo segetum, Ustilago carbo*). (3) *Rust, red-rag, red-robin*, or *red-gum*, caused by the young state of *Puccinia graminis*. (4) *Mildew*, produced by the more advanced growth of *P. graminis*. (5) *Ergot*, caused by the *Claviceps purpurea*, and which is as powerful in its action on the uterus as ergot of rye. Two diseases of wheat are produced by parasitical animalcules, viz.: (1) *Ear-cockle, purples*, or *pepper corn*, caused by a microscopic, eel-shaped, animalcule, called *Vibrio tritici*, or *Anguillula tritici*. (2) *Wheat midge*, an abortion of the grains caused by a minute, 2-winged fly called *Cecidomyia tritici* (P.).

Description and Chemical Composition.—*Flour* is the finely sifted, amylaceous constituent of the wheat; the broken, integumentary structures constitute *bran*. Good wheat flour is very white, has a faint, peculiar odor, and is nearly tasteless. One hundred parts of air-dry wheat contain, on an average, 13.37 per cent moisture, 12.04 per cent gluten and other nitrogenous matter, 1.91 per cent fatty matter, 69.07 per cent starch, gum, dextrin, and sugar, 1.9 per cent crude fiber, and 1.71 per cent ash. These figures, recorded by J. König (*Nahrungs und Genuss-mittel*, 3d ed., 1893), represent the average of 1358 analyses of wheat from all parts of the globe. The ash consists of silica, and phosphates of potassium, calcium, magnesium, and sodium, these bases also occurring as sulphates and chlorides. According to the same authority, the composition of wheat-bran is subject to great variation, and the average of 166 analyses is as follows: 15.66 per cent moisture, 14.61 per cent nitrogenous matter, 3.9 per cent fat, 53.6 nitrogen-free extractive matter (starch), etc., 6.7 per cent crude fiber, and 4.94 per cent ash. Richardson and Crampton (1886) found *allantoin* ½ per cent, a quickly drying oil, wax, cane sugar, and a sugar possessing strongly dextrogyre properties. The proportion of these constituents in wheat grains varies according to climate, soil, mode of culture, quality of manure, time of cutting, etc. The starch, which constitutes at least one-half of wheat grains is of finer quality, and of greater density than that from most other sources (see *Amylum*). The nitrogenous or protein matter of wheat consists of small amounts of *vegetable albumin* (about 1.6 per cent), and predominant amounts of the proteids of *gluten*, viz.: *Gluten casein* (Liebig's *vegetable fibrin*), insoluble in alcohol, and *gluten fibrin, gliadin* (glutin or vegetable gelatin) and *mucedin*, the latter three being soluble in alcohol of about 80 per cent strength (Ritthausen). The gluten of wheat is usually assumed as the most perfect form of that principle, and is more abundant in wheat than any other grain, rendering wheat flour superior in the manufacture of bread. It is through the presence of gluten that flour can be made into bread. The added quantity of yeast causes vinous fermentation, with evolution of carbonic acid gas, which expands the gluten into vesicles, and gives to the baked bread its spongy character. If wheat flour be kneaded into a paste with a little water, it forms a tenacious, elastic, soft, ductile mass. This is to be washed cautiously, by kneading it under a small stream of water till the water no longer carries off any starch, and runs off colorless; *gluten* remains. It is of a gray color, exceedingly tenacious, ductile, and elastic, has a peculiar smell, and is nearly tasteless. On exposure to the air it slowly dries, forming a hard, brittle, slightly transparent, dark-brown substance, resembling glue, which breaks like glass, with a vitreous fracture, imbibes water, but loses its tenacity and elasticity by boiling. It decomposes rapidly in a moist atmosphere, emitting a very offensive odor. *Gluten casein* in its reactions exhibits some resemblance to the casein of milk. It is insoluble in pure water, soluble in alkaline water, and precipitated from this solution by acids. It is separated from the gluten of the wheat by treatment with successive portions of alcohol of definite strength, in which it is insoluble. *Gluten fibrin, mucedin*, and *gliadin*, the constituents of gluten proper, are soluble in alcohol of 60 to 80 per cent, their separation being effected by their difference in solubility in water. Gliadin or vegetable gelatin is the constituent that imparts to the gluten its cohesive qualities.

As regards the wheat flour of the markets, we prefer flour ground in the stone mill, bolted in the old style, rather than the white starch flour known as patent process flour. A more recent view of the composition of gluten is that adopted by Osborne as recorded by Dr. H. W. Wiley (*Principles and Practice of Agricultural Analysis*, 1897, Vol. III, p. 436), from which the following is an abstract: "The gluten of wheat is composed of two proteid bodies, gliadin and glutenin. Gliadin contains 17.66 per cent, and glutenin 17.49 per cent of nitrogen. Gliadin forms a sticky mass when mixed with water, and is prevented from passing into solution by the small amount of mineral salts in the flour. It serves to bind together the other ingredients of the flour, thus rendering the dough tough and coherent. Glutenin serves to fix the gliadin, and thus to make it firm and solid. Glutenin alone can not yield gluten in the absence of gliadin, nor gliadin without the help of glutenin. Soluble metallic salts are also necessary to the formation of gluten, and act by preventing the solution of the gliadin in water, during the process of washing out the starch. No fermentation takes place in the formation of gluten from the ingredients named. The gluten which is obtained in an impure state by the process above described, is therefore not to be regarded as existing as such in the wheat kernel or flour made therefrom, but to arise by a union of its elements by the action of water."

The milky liquid produced by washing wheat flour, as above named, contains in solution gum, sugar, and vegetable albumen. *Vegetable albumen* may be obtained by allowing this fluid to deposit its starch, pouring off the supernatant liquor, and heating it to 60° to 71.1° C. (140° to 160° F.); flakes of coagulated albumen are formed. Vegetable albumen is soluble in water, but when coagulated by heat it is insoluble; it is also insoluble in alcohol and ether. When dry it is opaque, white, gray, brown, or black, according to circumstances, and is not adhesive like gum. Solutions of alkalies readily dissolve it. Vegetable albumen possesses nearly all the characters of animal albumen, and is considered identical in composition with it.

Wheat is now much subject to adulteration in this country by the wholesale admixture of white corn flour; the most we have to fear, however, is diseased wheat; but an examination under the microscope will at once detect parasitical growths, or their spores, etc.

Action and Medical Uses.—Wheat is very nutritive when made into bread or cakes and baked. Toasted bread, infused in water, forms an agreeable and lightly nourishing drink for invalids, especially those suffering from *febrile* or *inflammatory attacks*. It may be sweetened with loaf sugar, or a little molasses, and flavored, if desired, with strawberry juice, raspberry juice, lemon juice, etc., or the syrups of these fruits may be added to flavor it. Wheat flour is occasionally used to lessen the *itching* and *burning sensations* produced by *urticaria*, *scalds*, *burns*, *erysipelas*, etc.; rye-flour, however, is considered to act more efficiently. It is to be dusted upon the affected parts. It cools the part, excludes the air, and absorbs any discharges present, forming with them a crust which effectually protects the part underneath. When bread is soaked in milk, boiling hot, it forms the emollient bread and milk poultice; a small quantity of sweet lard or olive oil added improves it; yeast, with or without charcoal, mixed with this, forms an excellent antiseptic poultice; or, if powdered mustard be added, a sinapism is formed. When a bread poultice is applied to inflamed parts, the addition of a solution of borax will frequently facilitate its action. When it is desired to administer very small doses of remedial agents, this may be accomplished by mixing them with the crumb of bread (*mica panis*) in pill form. But nitrate of silver, if used thus, will be converted into a chloride, by the reaction ensuing between it and the salt in the bread. Wheat flour lightly baked, so as to acquire a pale buff tint, forms an excellent food for infants, invalids, and convalescents. It may be boiled with milk or milk and water, and lightly salted or sweetened as desired.

A very useful article of diet for patients, suitable in nearly all *chronic affections* has been recommended by Dr. T. J. Wright, of Cincinnati: The seeds of wheat are to be well cleansed by several washings in cold water, saving only those which sink to the bottom. Cover these with water, allow them to stand for 12 or 15 hours, then pour off the water, add some more, and boil for 2 or 4 hours, or until the spermoderm is cracked, then remove the wheat from the water. When cold it is ready for use. Small quantities only should be prepared at a time, especially in warm weather. This may be eaten with molasses, or sugar, the same as with boiled rice, or it may be boiled in milk or water, and be formed into a gruel, with the addition of a sufficient amount of Indian meal. It is nutrient and laxative.

Bran (*Furfures Tritici*), in decoction or infusion, is sometimes employed as an emollient foot-bath; it is also taken internally as a demulcent in *catarrhal affections.* Its continued use causes a *relaxed condition of the bowels.* Bran poultices are sometimes used, warm, in *abdominal inflammations, spasms,* etc. Bread made from unsifted flour has been found beneficial in *indigestion* and *constipation.* The following forms a good bread for patients laboring under *diabetes.* Wash coarse wheat bran thoroughly with water on a sieve until the water passes through clear; dry this in an oven, grind it to a fine powder, and to 7 eggs, 1 pint of milk, ¼ pound of butter, and a little ginger, add enough of the bran flour to make a paste; divide into 7 equal parts, and bake in a quick oven, say from 20 to 25 minutes (P.).

Related Species.—*Vicia Faba*, Linné (*Faba vulgaris*, Mœnch), *Horse bean, Windsor bean.* The seeds of this plant furnish a flour known as Farina Fabæ. The seeds contain 2 parts of sugar, 2 parts of fat, 36 parts of starch, 9 parts of gummy matter, and 24 parts of legumin. The stalks and husks of this bean, when calcined and digested in white wine, are diuretic; the flowers, in aqueous infusion, are reputed efficient in *gravel* and *gout;* and the flour has long been a domestic remedy in Europe for *diarrhœa.*

Phaseolus vulgaris, Linné; *Kidney bean; Common bean.*—This bean furnishes a flour, Farina Phaseoli, whose composition does not vary greatly in proportions from that of the foregoing. The legumes are likewise diuretic, and, according to Soltsien (*Archiv. der Pharm.*, 1884, p. 29), yield an alkaloid, *phaseoline.*

Lolium temulentum, Linné (*Lolium arvense*, Withering); *Bearded darnel.*—This plant is of interest chiefly from the fact that its fruit, or caryopsis, is frequently found with wheat or other grains, and is reputed to possess intoxicant and poisonous qualities. Though common in the grain fields of Europe and western Asia, it is not plentiful in this country, where it has been introduced by sowing grain containing its seed. The fruit is about ¼ inch long, oblong-ovoid, usually covered with the palæ, smooth, with a convex outer and furrowed inner surface, and of a light-brown color. Internally, the seed is whitish, farinaceous, and has a starchy, bitter taste, but no odor. Several attempts have been made to isolate the toxic principle. The ordinary grain constituents are found in the fruit, a large portion of which (30 to 50 per cent) consists of circular, non-striated starch cells, about ⅓ the size of those of wheat. The toxic principles of the plant, according to Ludwig and Stahl (1864), are an amorphous, bitter, acrid, yellowish glucosid, dissolving in water, ether, and alcohol, and a fixed oil of an acrid character. Others believed the poisonous body to be an acid substance, while still others have ascribed its action to an oily, non-saponifiable body. *Loliin*, an acrid, dirty-white amorphous body, was isolated by Bley, in 1838. P. Antze (*Amer. Jour. Pharm.*, 1891, p. 568) found what he supposed were two alkaloidal bodies, *loliine* (volatile) and *temulentine*, which were shown by Hoffmeister (1892) to be respectively impure ammonia and a mixture containing some of the narcotic principle discovered by him, to which he applied the name *temuline.* This is an amorphous alkaline body, probably a pyridine derivative, and soluble in water. An amorphous alkaloid and a nitrogenized acid were also detected by the same author. Temuline is poisonous (*Amer. Jour. Pharm.*, 1892, p. 611). The symptoms produced by lolium are analogous to those of alcoholic intoxication. Horses, sheep, and dogs are poisoned by it, while cows and hogs remain unaffected, and ducks and quail fatten upon it. Headache, dizziness, disordered vision (sometimes yellow), tinnitus aurium, præcordial oppression and anxiety, lingual paresis, vomiting, diarrhœa, increased renal action, muscular tremors, cold perspiration, and deep narcosis, sometimes proving fatal, are the effects upon man. Lolium has been applied as a poultice to arrest *pains* of a *neuralgic* and *rheumatic character*, and in *pleurisy.* Liquors were once adulterated with darnel, and some even suspect its use at the present day, to add to the intoxicating qualities of some beverages.

Phalaris, *Canary seed.*—The fruit of *Phalaris canariensis*, Linné, of the Mediterranean basin. It is much used as a food for birds, and, mixed with wheat or rye, has been ground into flour for the use of man. Poultices are also made of it. The fruit is small (⅛ inch) flattened, elliptic or ovate, covered by a shining yellow-gray paleæ. The kernel is brownish externally, white internally, inodorous, and feebly bitter. The fruit (*Fructus canariensis*, or *Semen canariensis*) is composed mainly of starch.

FEL BOVIS (U. S. P.)—OX-GALL.

"The fresh bile of *Bos Taurus*, Linné. *Class:* Mammalia. *Order:* Ruminantia"—(*U. S. P.*).

Synonyms: *Fel tauri, Fel bovinum, Bilis bubula.*

Source and Description.—The bile of the ox, the fluid secretion of the liver, is of variable consistence, being sometimes limpid, but more commonly viscid and ropy. It is denser than water, but mixes with this fluid in every proportion. As described by the *U. S. P.* it is a "brownish-green or dark-green, somewhat viscid liquid, having a peculiar, unpleasant odor, and a disagreeable, bitter taste. Specific gravity 1.018 to 1.028 at 15° C. (59° F.). It is neutral, or has a faintly alkaline reaction on litmus paper"—(*U. S. P.*). It is employed in the preparation of purified ox-gall (*see Fel Bovis Purificatum*).

Chemical Composition.—Ox-gall consists of about 90 per cent of *water*, the rest being composed mainly of two classes of substances peculiar to bile, called "*gall acids*" and "*gall pigments*." Besides, there are present *fatty matter* (palmitin, stearin, olein, soaps), *mucus*, *albuminous* and *mineral matter*. and traces of *urea;* also the base, *cholin*, and a crystallizable monatomic alcohol, named *cholesterin*.

Cholesterin ($C_{26}H_{43}.OH$) forms the chief ingredient of certain biliary calculi, especially those of human beings. It is also a normal constituent of the brain. the blood, of pus, the intestines, and the yolk of eggs. It also occurs in the seed-embryo of many plants, although an analogous body, *phytosterin*, frequently takes its place therein. *Cholesterin* is insoluble in water, soluble in chloroform, ether, and boiling alcohol, crystallizing upon cooling, and fuses at 145° C. (293° F.). It does not dissolve in diluted acids, nor does boiling with caustic alkali affect it in the least. When cholesterin is dissolved in chloroform and an equal volume of strong sulphuric acid is added, the cholesterin solution assumes a bluish-red, or violet-red color. When placed into a porcelain dish, the color changes from blue to green and finally yellow (*Salkowski's Test*).

The coloring matters of bile or *gall pigments* largely reside in the following:

I. *Bilirubin* ($C_{16}H_{18}N_2O_3$) is the chief coloring principle of bile, and is a red body of an acid character. and is found in appreciable quantities in gall stones in the form of a calcium compound. Usually amorphous, it may be obtained in crystals from its chloroformic solution. It is less soluble in alcohol, sparingly so in ether, and insoluble in water. The alkali compounds of bilirubin are insoluble in chloroform, a behavior that affords a means of its isolation. The close connection of bilirubin with the hæmatin obtainable from blood, has been suggested.

II. *Biliverdin* ($C_{32}H_{36}N_4O_8$), a green pigment of the bile, is formed by oxidation of bilirubin, especially in alkaline solution, by mere exposure to the air. Biliverdin, as thus obtained, is soluble in alcohol and alkalies, but not in water, chloroform or ether. Acids precipitate it from its alkaline solutions.

III. *Bilifuscin* ($C_{16}H_{20}N_2O_4$, Staedeler) is a brown pigment, soluble in alcohol and nearly insoluble in ether, chloroform, and water. As to other bile pigments, *biliprasin*, *bilihumin*, and *bilicyanin* have been abstracted from gall stones.

Gmelin's Test for bile pigments, which is very delicate, and may be applied to the examination of urine for these pigments, is carried out as follows: Render the suspected liquid faintly alkaline in a test tube, and allow a solution of nitric acid, containing a small amount of nitrous acid, to pass below this liquid. A play of colors will then be noticed at the line of demarkation in the following order from above downward: Green, blue, violet, red, and reddish-yellow. (For an explanation of the chemical processes involved in this reaction, see Hammarstin and Mandel, *Text Book of Physiological Chemistry*, 1893, p. 154.)

The *gall acids* are of 2 groups, and exist in bile in the form of sodium salts. These acids are:

I. *Glycocholic acid* ($C_{26}H_{43}NO_6$) which contains nitrogen, but no sulphur, and occurs mostly in the bile of herbivora.

II. *Taurocholic acid* ($C_{20}H_{45}NSO_7$) which, as the formula indicates, contains both nitrogen and sulphur. It is the main constituent of the solids in the bile of man and carnivora, also of oxen, sheep, and goats.

Glycocholic acid (the *cholic acid* of Strecker and Gmelin), when boiled with excess of alkali, is split into nitrogen-free and crystallizable *cholic acid* (Strecker's *cholalic acid*, $C_{24}H_{40}O_5$), and *glycocoll* (*glycin*, or *amido acetic acid*, $CH_2.NH_2.COOH$), the interesting compound obtained also by the decomposition of hippuric acid and of gelatin. Glycocholic acid forms silky acicular crystals more soluble in hot than in cold water, soluble in alcohol, sparingly soluble in ether. Its solutions have a bitter-sweetish taste. The aqueous solutions of its salts with alkalies are precipitated by solutions of heavy metals, also by the addition of an acid.

Taurocholic acid ($C_{26}H_{45}NSO_7$) (*choleic acid* of Strecker) occurs in silky needles, readily soluble in water and alcohol, but insoluble in ether. When boiled with alkalies it readily splits into *cholic acid* and *taurin* ($C_2H_4[NH_2].SO_3H$), or *amido isethionic acid*, a crystallizable substance, soluble in hot water. It has a neutral reaction, since it is both a base and an acid, yet it forms salts with alkalies.

The *bile acids* give Pettenkofer's reaction, which takes place with both the glycocholic and the taurocholic acids, owing to their common constituent, *cholic acid;* yet a variety of cholic acids are known, one of these having received the name *fellic acid.* Pettenkofer's reaction is executed, according to directions of the *U. S. P.*, as follows: "A mixture of 2 drops of ox-gall and 10 Cc. of water, when treated, first, with a drop of a freshly prepared solution of 1 part of sugar in 4 parts of water, and afterward with sulphuric acid, cautiously added, until the precipitate first formed is redissolved, gradually acquires a brownish-red color, changing, successively, to carmine, purple, and violet"—(*U. S. P.*).

FEL BOVIS PURIFICATUM (*U. S. P.*), *Purified ox-gall, Purified ox-bile, Fel tauri depuratum. Preparation.*—"Take fresh ox-gall, three hundred cubic centimeters (300 Cc.) [10 fl℥, 70 ♏]; alcohol, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Evaporate the ox-gall, in a tared porcelain capsule, on a water-bath, to about one hundred grammes (100 Gm.) [3 oz. av., 231 grs.], then add to it the alcohol, mix the whole thoroughly, and set it aside, well covered, for 3 or 4 days. Then decant the clear solution, filter the remainder, and, having mixed the liquids and distilled off the alcohol, evaporate the remainder to a pilular consistence"—(*U. S. P.*).

Description.—Purified ox-gall is officially described as a "yellowish-green, soft solid, having a peculiar odor, and a partly sweet and partly bitter taste. Very soluble in water and in alcohol. A solution of 1 part of purified ox-gall in about 100 parts of water behaves towards sugar and sulphuric acid in the same manner as the solution mentioned under ox-gall (see *Fel Bovis*). An aqueous solution of purified ox-gall should be clear, and should remain transparent upon the addition of an equal volume of alcohol (evidence of proper purification)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Hepatic, aperient, and tonic. The chief use of this product is for *constipation*, depending upon intestinal atony. Used in *intermittents, dyspepsia, torpor of the liver, jaundice, colic, diarrhœa, dysentery*, etc., when these depend upon a faulty secretion of bile. Five to 8 grains of inspissated gall neutralize the constipating and narcotic effects of 1 grain of opium, without injuring the sedative influence. Dose, from 1 to 10 grains.

A mixture of inspissated ox-bile, 3; extract of conium, 1; soda-soap, 2; olive oil, 8; has been highly extolled as a local application to effect the resolution of *hypertrophied organs.* Bonorden found applications of bile to the eye by instillation, or by means of a hair pencil, 5 or 6 times a day, very beneficial in kindred conditions of the eye, as *pannus, corneal opacity*, and *staphyloma* (*Med. Times and Gaz.*, 1858, p. 353).

FERRI ACETAS.—FERRIC ACETATE.

FORMULA: $Fe_26C_2H_3O_2$. MOLECULAR WEIGHT: 464.96.

SYNONYM: *Acetate of iron.*

Preparation.—(See *Liquor Ferri Acetatis*).

Description.—This solution has a deep-red color, and an acid and strongly chalybeate taste. The salt can not be obtained in dry state, and the solution is liable to decomposition. It is incompatible with alkalies and their carbonates, the strong acids, and vegetable astringent infusions.

Action, Medical Uses, and Dosage.—Tonic and astringent, and possesses the general medical properties of the preparations of iron. A diluted solution of it, with a few drops of creosote, will be found a valuable injection in *leucorrhœa.* Dose, 5 to 20 drops, in water (see *Tinctura Ferri Acetatis*).

Specific Indications and Uses.—(See *Tinctura Ferri Acetatis*).

FERRI ARSENAS.—IRON ARSENATE.

FORMULA: Fe_32AsO_4. MOLECULAR WEIGHT: 445.18. (As regarded by some, it is FERROSO-FERRIC ARSENATE, $3Fe(FeO)AsO_4+16H_2O$; molecular weight, 1086.74).

SYNONYMS: *Ferrum arsenicum, Ferrous arsenate, Arsenias ferrosus.*

Preparation.—Dissolve sodium acetate 3 parts, and dried sodium arsenate 4 parts, in boiling distilled water 32 parts; pour this solution into another hot solution made by dissolving ferrous sulphate 9 parts, in distilled water 48 parts. Wash the precipitate well and dry it (see Lloyd's *Chemistry of Medicines*). In the preparation of this salt the *British Pharmacopœia* directs sodium arsenate (dried at 148.9° C. [300° F.]) $15\frac{3}{4}$ parts, ferrous sulphate $20\frac{3}{4}$ parts, and sodium bicarbonate $4\frac{1}{2}$ parts. The product is dried on a porous brick at a temperature not higher than 37.7° C. (100° F.), in a warmed air chamber.

Description.—The dense white precipitate thrown down has the composition Fe_32AsO_4, but even in the process of preparation, this salt, as it dries through the atmospheric oxidation, changes to various shades of green and blue, finally becoming olive or blue-green in color. It is then regarded as *ferroso-ferric arsenate* ($3Fe[FeO]AsO_4.16H_2O$), and very much resembles blue phosphate of iron, with which it may be confounded. It is an amorphous, tasteless, odorless powder. Water or alcohol will not dissolve it, though its solution may be effected by diluted acids. It reacts with both ferrocyanide and ferricyanide of potassium, with the former yielding a pale-blue precipitate, and with the latter, a denser, deeper blue precipitate. Its hydrochloric acid solution should not be precipitated by barium chloride (absence of sulphates). If a small portion be boiled with a solution of caustic potash in excess, filtered, and treated with nitric acid to exact neutralization, solution of nitrate of silver will give a brick-red precipitate of silver arsenate. A yellow precipitate (arsenic sulphide), is produced by treating a solution of this salt with hydrogen sulphide.

Action, Medical Uses, and Dosage.—The action of this salt is due chiefly to the arsenic, as the proportion of iron is very insignificant. Carmichael applied this agent as a caustic to *cancerous ulcers* in the following form: Take of arsenate of iron 1 part, phosphate of iron 4 parts, spermaceti cerate 12 parts; triturate together. Biett has used it in *herpetic*, *scrofulous*, and *cancerous affections*, in doses of $\frac{1}{16}$ of a grain, once or twice a day, in pill form, thus: Take of arsenate of iron 3 grains, powdered marshmallow $\frac{1}{2}$ drachm, extract of hops 2 drachms, simple syrup, a sufficient quantity; beat well together and divide into 48 pills. Dose of ferrous arsenate, $\frac{1}{16}$ to $\frac{1}{5}$ grain, 3 times a day.

FERRI BROMIDUM.—FERROUS BROMIDE.

FORMULA: $FeBr_2$. MOLECULAR WEIGHT: 215.40.

SYNONYMS: *Bromide of iron*, *Ferrum bromatum*.

Preparation and Description.—Bromine combines directly with iron to form bromide of iron, represented by the above formula and molecular weight. When the two elements are placed together, the chemical reaction is violent, with evolution of heat, and large amounts of bromine are lost by evaporation. For this reason, precautions must be taken to control the reaction. Theoretically, 56 parts of iron are sufficient for 160 parts of bromine; yet, in practice, it is advisable to use a larger proportion of the former. The following process is sufficiently practical for the preparation of bromide of iron on a small scale: Into a chemical flask introduce 2 fluid ounces of distilled water and 1 troy ounce of clean, coarse iron turnings, or iron wire, and surround the flask with ice and water; now add $\frac{1}{2}$ ounce (troy) of bromine, and agitate occasionally, until the solution has almost lost its red color; to the solution, when cold, again add a like amount of bromine, and, when the reaction is finished, add another $\frac{1}{2}$ ounce (troy) of bromine, and so continue successively until a total of 2 troy ounces of bromine has been used; after each addition, permit the reaction to cease, and the liquid to cool. Now warm the flask, and, when the solution has acquired a greenish color, filter quickly; wash the excess of iron and the liberated carbon (that is always present in the iron), with a little distilled water, and filter into the former solution. Transfer this solution at once into a clean iron dish, placed upon a sand bath, and quickly evaporate, until a portion, removed upon a glass rod, will solidify upon cooling; then remove the dry salt, immediately, into well-stoppered bottles. When the reaction is completed with the first portion of bromine, the solution of bromide of iron possesses the power of dissolving bromine, and consequently, the following portions of bromine are dissolved and diluted, thus modifying the chemical action. Solution of bromide of iron absorbs oxygen with avidity, and the most rapid evaporation will not entirely prevent it. Bromide of iron is of a grayish-black color, acquiring a rusty color upon exposure. It is used in aqueous solution preserved with sugar (see *Syrupus Ferri Bromidi*).

Action, Medical Uses, and Dosage.—Bromide of iron is an uncertain and poisonous agent, and if employed at all internally, it should be with the greatest caution. It is highly probable that the iron furnishes but a very minute amount of any therapeutic value it may possess; and the constant tendency to decomposition renders it an undesirable agent. It is stated to have proved efficient in *scrofulous* and *tuberculous diseases*, in *glandular enlargements*, in some *cutaneous affections*, in *muscular hypertrophy*, *erysipelas*, *leucorrhœa*, *spermatorrhœa*, *bronchocele*, *amenorrhœa*, and even in *phthisis*. It is given internally in the form of syrup in doses of ½ to 1 fluid drachm, and the solution also is applied locally, by means of a camel's hair pencil, or a feather, to the external maladies. Its virtues, if any, are undoubtedly due to the bromine present; on this account some other of the bromides that may be safely administered should be employed when a bromide is indicated; and should iron be also indicated, it can be given separately. Bromide of iron is considerably employed in the manufacture of bromide of potassium.

FERRI CARBONAS SACCHARATUS (U. S. P.)—SACCHARATED FERROUS CARBONATE.

FORMULA of Anhydrous Ferrous Carbonate: $FeCO_3$. MOLECULAR WEIGHT: 115.73.

SYNONYMS: *Saccharated carbonate of iron, Ferri carbonas saccharata, Carbonas ferrosus saccharatus.*

Preparation.—"Ferrous sulphate, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; sodium bicarbonate, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; sugar, in fine powder, distilled water, each, a sufficient quantity to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Dissolve the ferrous sulphate in two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of hot distilled water, and the sodium bicarbonate in five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of distilled water at a temperature not exceeding 50° C. (122° F.), and filter the solutions separately. To the solution of sodium bicarbonate contained in a flask having a capacity of about one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], add, gradually, the solution of ferrous sulphate, and mix thoroughly by rotating the flask. Fill up the flask with boiling distilled water, cork it loosely, and set the mixture aside. When the precipitate has subsided, draw off the clear, supernatant liquid by means of a siphon, and then fill the flask again with hot distilled water, and shake it. Again draw off the clear liquid, and repeat the washing with hot distilled water in the same manner until the decanted liquid gives not more than a slight cloudiness with barium chloride test-solution. Finally drain the precipitate thoroughly on a muslin strainer, transfer it to a porcelain capsule containing eighty grammes (80 Gm.) [2 oz. av., 360 grs.] of sugar, and mix intimately. Evaporate the mixture to dryness, by means of a water-bath, reduce it to powder, and mix intimately with it, if necessary, enough well-dried sugar to make the final product weigh one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Keep the product in small, well-stoppered bottles"—(*U. S. P.*).

The reaction involved herein takes place according to the following equation: $FeSO_4+2Na_2HCO_3=FeCO_3+Na_2SO_4+CO_2+H_2O$. The precipitate of ferrous carbonate rapidly absorbs oxygen from the air, turns brown and gradually parts with its carbon dioxide. The sugar added to the moist carbonate is believed to envelop its particles and thus protect them from oxidation. The precautions taken in the preparation of *Vallet's mass* has this point in view, inasmuch as the precipitate of ferrous carbonate is to be washed out with water containing syrup.

Description.—The *U. S. P.* describes saccharated carbonate of iron as "a greenish-brown powder, gradually becoming oxidized by contact with air, without odor, and having at first a sweetish, afterward a slightly ferruginous, taste. Only partially soluble in water, but completely soluble in hydrochloric acid, with copious evolution of carbonic acid gas, forming a clear, greenish-yellow liquid"—

(*U. S. P.*). Cold water dissolves the sugar and a small quantity of iron, and if the solution be heated, it becomes yellow and turbid from the separation of hydrated peroxide of iron, with evolution of carbon dioxide.

Tests.—"If 1 Gm. of saccharated ferrous carbonate be dissolved in 5 Cc. of hydrochloric acid, and the solution diluted with water to the measure of 50 Cc., portions of this solution will afford a blue precipitate with both potassium ferrocyanide T.S. and potassium ferricyanide T.S., but should not be affected by barium chloride T.S. (absence of sulphate). If 1.16 (1.1573) Gm. of saccharated ferrous carbonate be dissolved in 10 Cc. of diluted sulphuric acid, and the solution diluted with water to about 100 Cc., it should require about 15 Cc. of decinormal potassium permanganate V.S. to impart a permanent pink tint to the liquid, corresponding to about 15 per cent of ferrous carbonate (each cubic centimeter of the volumetric solution indicating 1 per cent of pure ferrous carbonate)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This is a useful chalybeate tonic, superior to the carbonate of iron, but not equal to Vallet's pills of carbonate of iron, in in which the metal is more completely protected from oxidation (see *Pilulæ Ferri Carbonatis*). The dose is from 5 to 20 grains, in pill; it renders the stools greenish-black.

FERRI CHLORIDUM (U. S. P.)—FERRIC CHLORIDE.

FORMULA: $Fe_2Cl_6+12H_2O$. MOLECULAR WEIGHT: 539.5.

SYNONYMS: *Chloride of iron, Perchloride of iron, Sesquichloride of iron, Ferri perchloridum, Ferrum muriaticum oxydatum, Chloridum vel chloruretum ferricum.*

Preparation.—"Take of Iron, in the form of fine, bright wire, and cut into small pieces, fifteen grammes (15 Gm.) [232 grs.]; hydrochloric acid, nitric acid, distilled water, each, a sufficient quantity. Introduce the iron wire into a flask having a capacity of about two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏], pour upon it fifty-four grammes (54 Gm.) [1 oz. av., 396 grs.] of hydrochloric acid, previously diluted with twenty-five cubic centimeters (25 Cc.) [406 ♏] of distilled water, and let the mixture stand in a moderately warm place until effervescence ceases; then heat it to the boiling point, filter it through paper, and having rinsed the flask and iron wire with a little hot distilled water, pass the rinsings through the filter. To the filtered liquid add twenty-eight grammes (28 Gm.) [432 grs.] of hydrochloric acid, add the mixture slowly and gradually, in a stream, to eight grammes (8 Gm.) [124 grs.] of nitric acid, contained in a capacious porcelain vessel, and warm gently. After effervescence ceases, apply heat, by means of a sand-bath, until the liquid is free from nitrous odor. Then test a few drops of the liquid, diluted with water, with freshly prepared potassium ferricyanide test-solution. Should this reagent produce a blue color, add a little more nitric acid, drop by drop, as long as effervescence is observed, and evaporate off the excess. Then add five grammes (5 Gm.) [77 grs.] of hydrochloric acid, and enough distilled water to make the whole weigh sixty grammes (60 Gm.) [2 ozs. av., 51 grs.], and set this aside, covered with glass, until it forms a solid crystalline mass. Lastly, break the salt into pieces, and keep it in a glass-stoppered bottle, protected from light"—(*U. S. P.*).

This process does not differ materially from Wittstein's, for an account of which see King's *American Dispensatory*, 15th ed., p. 1010. Metallic iron is rapidly acted on and dissolved in the above process, ferrous chloride ($FeCl_2$), being formed in the first stage. The hydrogen gas set free possesses a disagreeable smell, which is due to admixed hydrocarbons originating from part of the carbon contained in the iron. The second stage of the process consists in the oxidation of the ferrous to ferric chloride in the presence of hydrochloric acid, by the action of the nitric acid. A sufficient amount of hydrochloric acid must be present in the liquid in order to avoid the presence of basic or oxychloride (see *Tests*, below). Another method of preparing solution of ferric chloride consists in dissolving ferric oxide in hydrochloric acid.

Description.—Ferric chloride is officially described as follows: "Orange-yellow, crystalline pieces, odorless, or having a faint odor of hydrochloric acid, and a strongly styptic taste. Very deliquescent in moist air. Freely and completely soluble in water and alcohol; also in a mixture of 1 part of ether and 3 parts of alcohol. At 35.5° C. (96° F.), the salt melts, forming a reddish-brown liquid. When strongly heated, it decomposes with the loss of water and hydrochloric acid, while the anhydrous salt sublimes, leaving a residue of ferric oxide"—(*U. S. P.*). Exposed to the light the salt becomes of lighter color, giving off a part of its chlorine and becoming ferrous chloride; the action of air and light must therefore be avoided.

Tests.—"The dilute, aqueous solution of the salt is acid to litmus paper, yields a brownish-red precipitate with ammonia water, a blue one with potassium ferrocyanide T.S., and a white one, insoluble in nitric acid, with silver nitrate T.S. If the iron be completely precipitated from a solution of the salt by an excess of ammonia water, the filtrate should be colorless, and should not yield either a white or a dark-colored precipitate with hydrogen sulphide T.S. (absence of zinc or copper); nor should it leave a fixed residue on evaporation and gentle ignition (absence of salts of the fixed alkalies). On adding a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and a moderately dilute solution of the salt, the crystal should not become colored brown, nor should there be a brownish-black color developed around it (absence of nitric acid). If to a dilute solution of the salt a few drops of freshly prepared potassium ferricyanide T.S., be added, a pure brown color should be produced, without a tinge of green or greenish-blue (absence of ferrous salt). A 1 per cent aqueous solution of the salt, when boiled in a test-tube, should remain clear (absence of oxychloride). If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 Cc.), in 10 Cc. of water and 2 Cc. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled and mixed with a few drops of starch T.S., it should require 20 Cc. of decinormal sodium hypophosphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 1 per cent of metallic iron)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Perchloride of iron is given in solution (see *Liquor Ferri Chloridi*), and is a powerful styptic. Internally, it has been successfully administered in *epistaxis*, *hemoptysis*, *hematemesis*, *menorrhagia*, *uterine* and other *hemorrhages* of a passive character, and in *hydruria*, *urinal incontinence*, and *catarrh of the bladder*, the dose being from 5 to 10 drops in a sufficient quantity of water, and repeating it 2, 3, or even 4 times a day. It has been used with asserted success in *pharyngeal diphtheria*. It has also been used in surgery, in the treatment of *aneurism* and *varicose veins;* a few drops of the concentrated solution of the perchloride is injected into the arteries or veins, under the influence of which all the blood within a distance of 2 or 3 lines is converted in a few minutes into a solid clot. Its use in aneurism has been abandoned owing to its having produced suppurative infiltration, or fatal embolism. It has not yet been determined what is the real mode of action of this salt on the blood. According to some, it coagulates the whole of the blood and all its elements; according to others, it acts only on the fibrin, and others, again, contend that its action is confined to the albumen. A solution of the salt, as named above, is the best form of preparation, though it decomposes on standing.

Perchloride of iron arrests *arterial* or *venous hemorrhage* resulting either from accident, or as a consequence of *surgical operations*. *Hemorrhage from the bowels* may be checked by an enema composed of from 20 to 25 drops of a concentrated solution of perchloride of iron to 7 ounces of fluid. *Hemorrhage from an abscess* may be checked by injecting a solution composed of 10 drops of the concentrated solution to 7 fluid ounces of water. Twenty drops to 3½ fluid ounces of water has been successfully used as an injection in *chronic gonorrhœa* or *leucorrhœa*, in weak and lymphatic subjects. As a local or external hemostatic, from 3 to 5 parts of perchloride of iron may be dissolved in 100 parts of distilled water; lint may be thoroughly moistened with this, and applied upon the seat of hemorrhage, with more or less pressure. One part of perchloride of iron to 500 parts of distilled water, and the solution sweetened and administered internally in proper doses, checks the most profuse hemorrhages in from 24 to 36 hours, and is also useful in *chronic diarrhœa;* without the sweetening, it is useful as an injection in *uterine* *flooding, cholera, colliquative diarrhœa*, etc. Many deaths have been attributed to its use in strong solutions as a means of arresting uterine hemorrhage. Mr. J. T. Lawrence says: "If the solid perchloride of iron be kept in a bottle, a small portion of it after a time deliquesces into a thick brown fluid, which is constantly kept in a state of supersaturation by the undeliquesced portions of the salt. This liquid, applied by means of a spun-glass brush, to a bleeding surface, arrests the bleeding almost instantaneously. This mode of application is particularly valuable in applying the styptic to such cases as *excision of the tonsils*, bleeding from the deeper-seated vessels of the gums, etc." The solution is considered effective in destroying *vascular nævi, erectile tumors*, and the *granulations of ingrown nails*. It has also been applied in *chilblains scrofulous ulcers, hospital gangrene, sweating feet*, and *rectal prolapse*. *Dense, confluent granulations* within the tympanic cavity are removed with a crystal or strong solution of chloride of iron with less pain than with silver nitrate (Foltz).

Jeannel proposed a perchloride of iron for therapeutical purposes, containing 5 molecules of oxide of iron. It is prepared with 100 parts of pure hydrochloric acid of sp. gr. 1.15, and 522 parts of ferric hydroxide containing 75 parts of water. Dissolve cold by trituration in a glass mortar, and filter. It forms a limpid, deep, garnet-red fluid, with an astringent, but not bitter taste. It very strongly coagulates blood and albumen, and the coagulum does not become redissolved, as is the case when the official perchloride is used; it is not painful when applied to wounds; may be readily dried on plates placed in a stove heated to 40° C. (104° F.), yielding blackish-brown, very soluble laminæ, which, when powdered, form an excellent local application for modifying *wounds* affected with *hospital gangrene, abscesses* of a bad character, *phagedenic chancres*, etc.

Related Salt.—FERRUM CHLORATUM, *Ferrous chloride, Chloridum ferrosum, Ferrum muriaticum oxydulatum*. *Formula:* $FeCl_2$. *Molecular weight:* 126.64. This salt may be easily made by digesting in a porcelain vessel iron turnings (1 part), in hydrochloric acid (4 parts), the latter having been previously diluted with distilled water (2 parts). The mixture is to be warmed, filtered, and carefully evaporated until the bulk is reduced to the measure of that of 3 parts of the acid employed. Add a little hydrochloric acid and allow it to crystallize in a cool situation (Lloyd's *Chem. of Med.*). Ferrous chloride forms pale-green crystals, and contains 4 molecules of water. In moist air it deliquesces, changing in color by oxidation gradually, from green to yellow. As stated before, the first step in the preparation of *ferric chloride* consists in the making of ferrous chloride. In Germany a *Liquor Ferri Chloratum* is prepared. Ferrous chloride has been given in doses of from 1 to 5 grains in that country.

FERRI CITRAS (U. S. P.)—FERRIC CITRATE.

FORMULA: $Fe_2(C_6H_5O_7)_2$ (for anhydrous salt). MOLECULAR WEIGHT: 488.84.
SYNONYMS: *Citrate of iron, Insoluble (?) citrate of iron, Ferrum citricum oxydatum, Citras ferricus*.

Preparation.—"Take of solution of ferric citrate, a convenient quantity. Evaporate the solution on a water-bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stoppered bottles, protected from light"—(*U. S. P.*).

Description and Tests.—"Thin, transparent, garnet-red scales, without odor, and having a slightly ferruginous taste. Slowly but completely soluble in cold water, and readily soluble in hot water, but diminishing in solubility by age. Insoluble in alcohol. When strongly heated, the salt chars, and finally leaves a residue of ferric oxide, which should not have an alkaline reaction upon litmus paper (absence of citrates or tartrates of the fixed alkalies). The aqueous solution of the salt has an acid reaction, and is not precipitated, but rendered darker in color, by ammonia water. With potassium ferrocyanide T.S. it produces a bluish-green color or precipitate, which is increased and rendered dark-blue by the subsequent addition of hydrochloric acid (difference from iron and ammonium citrate). When heated with potassium or sodium hydrate T.S., it affords a brownish-red precipitate, without evolving any vapor of ammonia. If a 10 per cent solution of the salt be deprived of its iron by boiling it with an excess of potassium or sodium hydrate T.S., and the filtrate be slightly acidulated with acetic acid, a portion of the cooled liquid, mixed with a little calcium chloride T.S., and again heated to boiling, will gradually afford a white, crystalline precipitate. Another portion of the acidulated and cooled liquid, when allowed to stand for some time, should not deposit a white, crystalline precipitate (absence of tartrate). If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 Cc.) in 15 Cc. of water and 2 Cc. of hydrochloric acid, with the aid of a gentle heat, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 16 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 1 per cent of metallic iron)"—(*U. S. P.*).

Iron and ammonium citrate is often sold under the name of *soluble citrate of iron.*

Action, Medical Uses, and Dosage.—(See *Ferri et Ammonii Citras*). Dose, 2 to 10 grains, in aqueous solution or pill.

FERRUM DIALYSATUM.—DIALYZED IRON.

SYNONYMS: *Liquor ferri dialysatus, Liquor ferri oxychlorati.*

Preparation.—The Paris Pharmaceutical Society (1876) adopted the following process: To 100 grammes (3½ fluid ounces) of solution of ferric chloride, sp. gr. 1.245, 35 grammes (1¼ fluid ounces) of ammonia water, sp. gr. 0.923 (=20.26 per cent) are slowly added, with constant stirring, and as soon as a clear solution has formed it is introduced into the dialyzer (see *Dialysis* below); the surrounding water, during the process of dialyzation, being frequently changed. When the contents of the dialyzer (as may be determined by testing a small portion from time to time) cease to precipitate a solution of nitrate of silver, and give no acid reaction, the operation is suspended.

Dr. W. H. Pile recommends the addition of solution of carbonate of sodium to the solution of chloride of iron, until a small portion of the resulting precipitate remains undissolved, and then to proceed with the dialysis. In this case, chloride of sodium passes through the septum. We believe the process now in general favor is to add freshly precipitated ferric hydrate to the solution of ferric chloride, until saturation ensues, and then dialyze the resulting liquid. In all cases the results of the operation are similar, and the solution within the dialyzer should, after the completion of the process, be brought to the proper standard by drying a given portion, and then adding distilled water in sufficient quantity to make 100 parts by weight of the solution contain 5 parts of the dry residue.

Description and Chemical Composition.—Dialyzed iron has a deep-red color, and is miscible with distilled water, glycerin, and syrup. Fixed organic acids, alkalies, and salts form with it a clear jelly. It is odorless and almost tasteless, merely imparting a slight rough sensation to the tongue. In composition it is a very basic oxychloride, and, as found in the market, differs considerably in constitution. It is not, as some have supposed, a neutral solution of oxide of iron. Specimens that are neutral to litmus paper, and that fail to show the presence of chlorine upon simply adding nitrate of silver to the solution of iron will, as Prof. Maisch has shown, give distinct precipitates, when a slight excess of ammonia water is previously added to the dialyzed iron, the mixture then filtered and the clear filtrate tested with solution of nitrate of silver. (For exhaustive articles on the subject we refer the reader to *Amer. Jour. Pharm.*, 1877–78).

According to the analyses of Prof. Trimble (*Amer. Jour. Pharm.*, 1878, p. 61), 6 specimens of commercial dialyzed iron varied in composition from $Fe_2Cl_6.11Fe_2O_3$ to $Fe_2Cl_6.31Fe_2O_3$. No specimen contained 5 per cent of solid matter, the highest being 4.831 per cent, the lowest 2.514 per cent. The specific gravity of 5 per cent dialyzed iron, according to Dr. W. H. Pile, is 1.029. Mr. E. B. Shuttleworth (*Canad. Pharm. Jour.*, 1877), states, however, that it is 1.034 if the evaporation of the solution tested has been conducted over an exposed water-bath, and 1.040 when the perfectly dry residue is 5 per cent. If calcined, a residue of 5 per cent indicates a solution of specific gravity 1.046. If the process of dialysis is carried to excess, the resultant solution is prone to thicken. This is often observed in dialyzed iron where extra care has been taken that the process be carried to the utmost extent (see *Dialysis* below).

Action, Medical Uses, and Dosage.—Dialyzed iron has been presented to the medical profession as a remedy devoid of any styptic, disagreeable taste, producing no heartburn, eructations, constipation, diarrhœa, or gastric disturbance, occasioning no blackening of the teeth, and being a ferric solution in a form closely resembling that of the iron in the blood. It has likewise been recommended as an antidote for *poisoning by arsenic*, fully as efficient as the hydrated sesquioxide of iron. Its dose is from 20 to 50 drops daily, or from 5 to 12 drops repeated 4 times a day. It may be dropped upon a lump of sugar, or be taken in a little water, wine, or coffee. This preparation has been recommended in all cases in which the administration of iron is indicated, but it has not given general satisfaction among those who have employed it; and from what has been gathered from those who have tested it as an arsenical antidote, it certainly appears to be an uncertain and unreliable remedy. Prof. Depaire, of the University of Brussels (*Jour. de Médecine de Bruxelles*, 1877) considers that this agent should be ranked among the least active of ferruginous preparations. Bouchardat, of Paris, France, says: "Theoretically, dialyzed iron appears to me to be the most untrustworthy of the ferruginous preparations in which the ferric oxide occurs, and for two reasons—the iron called *dialyzed*, does not pass through the dialyzer, it must then be illy adapted for absorption; under the influence of very small quantities of alkali, of alkaline earths, of acids, of divers substances contained in the food, it becomes converted into an insoluble compound." Physicians in Germany frequently prescribe it as follows: Take of dialyzed iron, cinnamon water, each, 15 fluid drachms; glycerin, alcohol, each, 2½ fluid drachms; mix. The dose of this for an adult is a dessertspoonful, repeated 3 or 4 times a day. Each spoonful contains 2.14 grammes (33 troy grains) of dialyzed oxide of iron, or 10 centigrammes (1½ troy grains) of dry oxide of iron.

Dialysis.—The name *dialysis* was applied, by Graham, to the act of separating certain bodies when in solution, by taking advantage of the fact that some substances pass more readily than others through certain gelatinous bodies. Those most diffusible, either crystallize or are closely related to crystalline classes, hence called *crystalloids*. The less diffusible prove to be those incapable of crystallizing, usually prone to assume the gelatinous form, being distinguished as *colloids*. The principle of dialysis has, occasionally, for some years, been applied in practice, as in separating arsenous anhydrid, and other metallic poisons, from liquids containing organic matter; also in the separation of the crystallizable constituents of urine, as urea, etc. A layer of gelatin will serve as a *dialyzer*, but a septum of animal membrane, such as bladder, or a piece of parchment, is better adapted to the purpose. The dialyzer is generally made by tying a sheet of parchment over a wooden hoop, or over a glass or rubber cylinder, or even over the wide open end of a funnel. The liquid to be dialyzed is then placed inside the vessel thus made, and the whole arrangement is permitted to float upon distilled water. In case the vessel is heavy, it is better to support it in such a manner that the surface of the liquid within the dialyzer will be a little above the surface of the surrounding water. This is necessary to prevent an excessive inflow of water, which, in some cases, renders the liquid very dilute before dialysis has progressed to any great extent.

From 9 to 14 days are generally required to complete the operation, but the process is influenced by the depth of the solution within the dialyzer, the extent of surface exposed, and the quality of the membrane employed, as well as by the attention given to a frequent change of the water in which the dialyzer floats. The most rapid work is accomplished with a constantly changing water below, and a thin stratum of liquid above, the membrane. The process of dialysis came into extensive use as a means of making *dialyzed iron*, but this preparation, in recent years, has largely fallen into disuse.

FERRI ET AMMONII CITRAS (U. S. P.)—IRON AND AMMONIUM CITRATE.

SYNONYMS: *Ammonio-ferric citrate*, *Ammonio-citrate of iron*, *Citrate of iron and ammonium*, *Soluble citrate of iron*, *Ferrum citricum ammoniatum*, *Ferro-ammonium citricum*, *Ferri ammonio-citras*.

Preparation.—"Take of solution of ferric citrate, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; ammonia water, forty cubic centimeters (40 Cc.) [1 fl℥, 169 ♏]. Mix the solution of ferric citrate with the ammonia water, evaporate the mixture, by means of a water-bath, at a temperature not exceeding 60° C.

(140° F.), to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stoppered bottles, protected from light"—(*U. S. P.*).

As made by the foregoing process, ammonio-ferric citrate has the rather constant composition, $Fe(C_6H_5O_7)NH_4OH$ (R. Rother, *Amer. Jour. Pharm.*, 1887, p. 170). The following process is taken from Lloyd's *Chemistry of Medicines:* "Dissolve the ferric oxide from 1 pint of solution of persulphate of iron (tersulphate *U. S. P.*), by digesting it in a porcelain dish, at a temperature of 82.2° C. (180° F.), with 4 ounces (av.) of citric acid, and 5 fluid ounces of *solution of citrate of ammonium.* (Solution of citrate of ammonium for this purpose is made by dissolving 8 ounces (av.) of citric acid in an excess of ammonia water, and evaporating the product until it is reduced to the measure of 16 fluid ounces). When solution is complete, evaporate the product to the consistence of syrup, and dry by spreading it on plates of glass and exposing it to the temperature of from 37.7° C. to 50° C. (100° to 120° F.)."

Description and Tests.—Iron and ammonium citrate is officially described as occuring in "thin, transparent, garnet-red scales, without odor, and having a saline, mildly ferruginous taste; deliquescent in moist air. Readily and completely soluble in water, but insoluble in alcohol. When strongly heated, the salt chars, and finally leaves a residue of ferric oxide, which should not have an alkaline reaction towards litmus paper (absence of citrates or tartrates of the fixed alkalies). The aqueous solution of the salt is neutral to litmus paper. The aqueous solution is not precipitated, but rendered darker in color by ammonia water. With potassium ferrocyanide T.S., the solution does not give a blue color or precipitate, unless it be acidulated with hydrochloric acid (difference from ferric citrate). When heated with potassium or sodium hydrate T.S., it affords a brownish-red precipitate, and vapor of ammonia is evolved. If a 10 per cent solution of the salt be deprived of its iron by boiling it with an excess of potassium or sodium hydrate T.S., and the filtrate slightly acidulated with acetic acid, a portion of the cooled liquid mixed with a little calcium chloride T.S., and again heated to boiling, will gradually deposit a white, crystalline precipitate. Another portion of the acidulated and cooled liquid, when allowed to stand for some time, should not yield a white crystalline precipitate (absence of tartrate). If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 Cc.) in 15 Cc. of water and 2 Cc. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 16 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 1 per cent of metallic iron)"—(*U. S. P.*). Being more soluble than citrate of iron, this salt is the substance usually prescribed and sold under the name *Citrate of iron* or *Soluble citrate of iron.* Should it deliquesce in the air, too much ammonia has been used in its production; if sour and of acid reaction, an excess of citric acid has been employed; and if dusty or finely divided, an excess of oxide of iron is present (Lloyd's *Chem. of Med.*). Ammonia is evolved when the salt is calcined.

Action, Medical Uses, and Dosage.—This salt, as well as citrate of iron, is a pleasant, ferruginous tonic, and may be given to children in ordinary cases of *debility*, *struma*, *anemia*, *tabes mesenterica*, etc. It does not constipate, and is easily assimilated, and is therefore a good iron tonic in *dyspepsia* with gastric irritability and marked anemia. The dose of either is from 4 to 10 grains in pill, or in water flavored with orange-peel, syrup, etc. The citrate is best given in the form of pill. The ammonio-citrate is not adapted for use in pill.

Specific Indications and Uses.—Anemia; skin pale, translucent, membranes pale, respiration accelerated; appetite morbid; patient restless and nervous.

Related Compound.—FERRI ET ZINCI CITRAS, *Iron and zinc citrate.* This preparation is but little used. It forms in brownish-green scales, and has a ferruginous and slightly metallic taste. As, in addition to the citrates of iron and zinc, it contains ammonia, it is more properly an "ammonio-citrate of iron and zinc." Used as a tonic in cases where iron is not contraindicated, as, in *anemia*, *chorea*, *epilepsy*, and other *diseases of the nervous system* The dose is from 2 to 5 grains, 2 or 3 times a day (H. N. Draper).

FERRI ET AMMONII SULPHAS (U. S. P.)—IRON AND AMMONIUM SULPHATE.

FORMULA: $(NH_4)_2Fe_2(SO_4)_4.24H_2O$. MOLECULAR WEIGHT: 962.1.

SYNONYMS: *Ammonio-ferric sulphate, Ammonio-ferric alum, Sulphas ammonico ferricus, Ferri ammonio-sulphas, Ferrum ammonio-sulphuricum, Ferrum sulphuricum oxydatum ammoniatum, Alumen ammoniacale ferricum, Ferrum sulfuricum oxydatum ammoniatum.*

Preparation.—The *U. S. P.* (1870) presents a formula for the preparation of this salt, in which it is recommended to "heat 2 pints of a solution of tersulphate of iron (see *Liquor Ferri Tersulphatis*) to the boiling point, then add to it 4½ troy ounces of sulphate of ammonium, and when this is dissolved, to set the fluid aside to crystallize, wash the crystals quickly with very cold water, wrap them in bibulous paper, and dry them in the open air." According to Lloyd's *Chemistry of Medicines*, it is not necessary to boil the solution; a temperature of 65.5° C. (150° F.) is sufficient.

Description and Tests.—According to Rose, *pure* ammonio-ferric alum is white, becoming colored only in aqueous solution, through the formation of a basic iron salt, a change which may be prevented by acidulating the solution with sulphuric acid. As usually met with in commerce, it is of amethyst-like color. "Ferric ammonium sulphate should be kept in well-stoppered bottles"—(*U. S. P.*).

The *U. S. P.* describes it as occurring in "pale violet, octahedral crystals, without odor, and having an acid, styptic taste; efflorescent on exposure to the air. Soluble in 3 parts of water at 15° C. (59° F.), and in 0.8 part of boiling water; insoluble in alcohol. When strongly heated, the crystals fuse, lose their water of crystallization, swell up, and finally leave a pale-brown residue. The aqueous solution of the salt has a slightly acid reaction, and yields with potassium ferrocyanide T.S. a blue precipitate, and with barium chloride T.S. a white precipitate insoluble in hydrochloric acid. With potassium or sodium hydrate T.S. it yields a brownish-red precipitate, and if the mixture be heated, vapor of ammonia is evolved. If all the iron be precipitated from a solution of the salt by treating it with an excess of potassium or sodium hydrate T.S., the resulting filtrate, when neutralized with hydrochloric acid, and then mixed with ammonia water, should not yield a white, gelatinous precipitate (absence of aluminum). If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 Cc.) in 15 Cc. of water and 2 Cc. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for ½ hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require not less than 11.6 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 1 per cent of metallic iron)"—(*U. S. P.*).

IRON ALUM was brought to the notice of the profession by Dr. Wm. Tyler Smith. Beside the *ammonio-ferric alum* before described, there exist other iron alums, in which the ammonium is replaced by potassium or sodium or other alkali metals. The *potassio-ferric alum* ($Fe_2[SO_4]_3.K_2SO_4.24H_2O$) (which is prepared exactly like ammonio-ferric alum, except that potassium sulphate is employed in the place of ammonium sulphate), has long been used in St. Mary's Hospital, London, as a more powerful astringent than common alum, and not liable to produce the stimulating effects of other salts of iron. *Ammonio-ferric alum* possesses similar properties.

Action, Medical Uses, and Dosage.—Dr. Wm. Tyler Smith speaks very highly of these iron alums in *leucorrhœa* in doses of from 3 to 10 or 15 grains, in infusion of columbo, or in water, repeated 3 times a day. They have also been found useful in *choleraic diarrhœa*, *dysentery*, and other disorders in which tonicity and astringency are required. They are more effective than the perchloride of iron, being at the same time less stimulating, more easily assimilated, and rarely causing any nausea or headache. Occasionally they induce slight constipation, which may be obviated by an occasional laxative, as magnesium sulphate, compound licorice powder, etc.

Related Preparation.—FERROSO-ALUMINIC SULPHATE. *Sulphate of aluminum and iron* ($Al_2Fe[SO_4]_4.24H_2O$). This substance may be formed by dissolving in an excess of sulphuric acid, recently precipitated ferrous carbonate and recently precipitated alumina in such proportions as are demanded by the above formula. By evaporating the solution thus formed, if kept in a warm situation, it deposits crystalline tufts of the ferroso-aluminic sulphate. It was introduced by Sir James Murray as an astringent, styptic, and anthelmintic. For its astringent effects it has been employed in *bowel disorders, night-sweats,* and *leucorrhœa.* The dose is from 5 to 10 grains in water. Locally used in *relaxed palate* and *uvula, sluggish ulcers,* and *hemorrhages.*

FERRI ET AMMONII TARTRAS (U. S. P.)—IRON AND AMMONIUM TARTRATE

SYNONYMS: *Ammonio-ferric tartrate, Ammonio-tartrate of iron, Ferri ammonio-tartras, Ferrum tartaricum ammoniatum.*

Preparation.—The following official process is practically based on that elaborated by Prof. Procter in 1841 (*Amer. Jour. Pharm.*, 1841): "Solution of ferric sulphate, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; tartaric acid, twenty-nine grammes (29 Gm.) [448 grs.]; distilled water, two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏]; ammonia water, water, each, a sufficient quantity. To one hundred and ten cubic centimeters (110 Cc.) [3 fl℥, 345 ♏] of ammonia water, previously diluted with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of cold water, add, with constant stirring, the solution of ferric sulphate, previously diluted with thirteen hundred cubic centimeters (1300 Cc.) [43 fl℥, 460 ♏] of cold water. When the precipitate has subsided, draw off the clear, supernatant liquid by means of a siphon, then mix the precipitate intimately with about fifteen hundred cubic centimeters (1500 Cc.) [50 fl℥, 346 ♏] of cold water, again draw off the clear liquid, and repeat the washing with water in the same manner until the decanted liquid gives not more than a slight cloudiness with barium chloride test-solution. Then transfer the precipitate to a wet muslin strainer, allow it to drain, and express the water as completely as possible. Dissolve one-half of the tartaric acid in the distilled water, neutralize the solution exactly with ammonia water, then add the other half of the tartaric acid, and dissolve it by the application of a gentle heat. Now add the moist ferric hydrate in successive portions, stirring constantly, and continue the heat, which should not exceed 60° C. (140° F.), until the hydrate is dissolved. Filter the solution while hot, evaporate it in a porcelain vessel, at or below the above-mentioned temperature, to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stoppered bottles, protected from light"—(*U. S. P.*).

In this process ammonium tartrate is first formed by neutralizing one-half the tartaric acid with ammonia water, and this by the further addition of acid, becomes a bitartrate. This is then digested with freshly made ferric hydroxide, the solution filtered, and cautiously evaporated, the double salt being then dried and scaled.

Description and Tests.—The official salt forms "thin, transparent scales, varying in color from garnet-red to reddish-brown, without odor, and having a sweetish, slightly ferruginous taste; slightly deliquescent in the air. Very soluble in water; insoluble in alcohol. When strongly heated, the salt chars, emits fumes having an odor of burning sugar, and finally leaves a residue of ferric oxide, which should not have an alkaline reaction upon litmus paper (absence of citrates or tartrates of the fixed alkalies). The aqueous solution of the salt is neutral to litmus paper, and is not precipitated, but rendered darker in color by ammonia water. With potassium ferrocyanide T.S. it does not afford a blue color or precipitate, unless it be acidulated with hydrochloric acid. When heated with potassium or sodium hydrate T.S., it yields a brownish-red precipitate, and vapor of ammonia is evolved. If a 10 per cent solution of the salt be deprived of its iron by boiling it with an excess of potassium or sodium hydrate T.S., the filtrate, when slightly acidulated with acetic acid, will gradually deposit a white, crystalline precipitate. If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 Cc.) in 15 Cc. of water and 2 Cc. of hydrochloric acid, and after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 17 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 1 per cent of metallic iron)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—A mild chalybeate, containing a small proportion of iron, but having the advantage of free solubility. Dose, 5 to 30 grains.

Related Compound.—Ferri et Quininæ Tartras, *Iron and quinine tartrate, Ferro-tartrate of quinine.* Take of crystallized tartaric acid, distilled water, each, by weight, 2 ounces; moist hydrated oxide of iron (ferric hydroxide), pure quinine, of each, a sufficient quantity. Boil the tartaric acid and the distilled water together in a glass or porcelain vessel; as soon as the acid is dissolved, add the iron as long as the fluid will dissolve it. Heat the mixture until the deep blood-red fluid becomes clear, and then add the quinine until the fluid ceases to dissolve it. Evaporate the solution by means of gentle heat to the consistence of thick syrup, and spread it in thin layers on glass to dry (Prof. J. M. Sanders). This salt is much more soluble than the citrate of iron and quinine. It forms in scales of a beautiful crimson color. It is incompatible with astringent vegetable infusions, strong acids, alkalies, and their carbonates. The ferro-tartrate of quinine is a valuable tonic, and may be used with benefit in *chlorosis, amenorrhœa, debility, anemia*, and during the remissions or intermissions from *fever;* also in *scrofula*, and whenever the union of quinine with a chalybeate is indicated. The dose is from 3 to 5 grains, 3 times a day, either in solution or in the form of pill.

FERRI ET POTASSII TARTRAS (U. S. P.)—IRON AND POTASSIUM TARTRATE.

Synonyms: *Potassio-ferric tartrate, Tartarated iron, Tartarized iron, Ferro-tartrate of potassium, Ferrum tartaratum, Ferri potassio-tartras, Ferrum tartarizatum, Ferri-Kali tartaricum, Tartras ferrico-potassicus, Tartras potassio-ferricus, Tartras ferrico-kalicus.*

Preparation.—"Solution of ferric sulphate, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; potassium bitartrate, thirty-eight grammes (38 Gm.) [1 oz. av., 149 grs.]; distilled water, three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏]; ammonia water, water, each, a sufficient quantity. To one hundred and ten cubic centimeters (110 Cc.) [3 fl℥, 345 ♏] of ammonia water, previously diluted with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of cold water, add, under constant stirring, the solution of ferric sulphate, previously diluted with thirteen hundred cubic centimeters (1300 Cc.) [43 fl℥, 460 ♏] of cold water. When the precipitate has subsided, draw off the clear, supernatant liquid by means of a siphon, then mix the precipitate intimately with about fifteen hundred cubic centimeters (1500 Cc.) [50 fl℥, 346 ♏] of cold water, again draw off the clear liquid, and repeat the washing with water in the same manner until the decanted liquid gives not more than a slight cloudiness with barium chloride test solution. Then transfer the precipitate to a wet muslin strainer, allow it to drain, and express the water as completely as possible. Mix the potassium bitartrate with the distilled water, in a porcelain vessel, heat the mixture, on a water-bath, to a temperature not exceeding 60° C. (140° F.), and gradually add the moist ferric hydrate, stirring constantly until it is dissolved. Filter the liquid while hot, and let the filtrate stand in a cool, dark place for 24 hours. Then stir it well with a porcelain or glass spatula, so that the precipitate which has formed in it may be thoroughly incorporated with the liquid. Now add, very cautiously, just enough ammonia water to dissolve the precipitate, evaporate the solution in a porcelain vessel, at or below the above-mentioned temperature, to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stoppered bottles, protected from light"—(*U. S. P.*).

This process very properly directs the addition of ammonia water in order to render the compound soluble, as recommended by G. H. Charles Klie (*Amer. Jour. Pharm.*, 1876, p. 170). J. U. Lloyd has shown (*New Remedies*, 1879, p. 324) that an excess of ammonia will cause darkening of the solution and the formation of a gelatinous tarry precipitate, and that it is absolutely necessary to restrict the ammonia water to the amount necessary to redissolve the reddish precipitate. This process had been used by him in a manufacturing way for several years.

Description and Tests.—"Thin, transparent scales, varying in color from garnet-red to reddish-brown, without odor, and having a sweetish, slightly ferruginous taste; slightly deliquescent in the air. Very soluble in water; insoluble in alcohol. When strongly heated, the salt chars, emits fumes having an odor resembling that of burning sugar, and finally leaves a dark-brown residue, having a strongly alkaline reaction, and effervescing with acids (distinction from iron and ammonium tartrate). The aqueous solution of the salt is neutral to litmus paper, and is not precipitated, but rendered darker in color, by ammonia water. With potassium ferrocyanide T.S. it does not afford a blue color or precipitate unless it be acidulated with hydrochloric acid. When heated with potassium or sodium hydrate T.S., it yield a brownish-red precipitate, and a slight odor of ammonia is evolved. If a 10 per cent solution of the salt be deprived of its iron by boiling it with an excess of potassium or sodium hydrate T.S., the filtrate, when slightly acidulated with acetic acid, will gradually deposit a white, crystalline precipitate. If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 Cc.) in 15 Cc. of water and 2 Cc. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 15 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 1 per cent of metallic iron)"—(*U. S. P.*). Of the ferric scale salts, this is one of the richest in iron. Some regard it as a double salt whose formula is $Fe_2(C_4H_4O_6)_3+K_2C_4H_4O_6+H_2O$. Flückiger regards its composition as $C_4H_4O_6K_2+C_4H_4O_6(Fe_2O_2)+H_2O$ (*Pharm. Chemie.*, 1879, p. 848).

Action, Medical Uses, and Dosage.—On account of its pleasant taste and lack of marked astringency, and its kindly action upon the gastro-intestinal tract, as well as the large proportion of iron it contains, this is regarded as one of the most valuable of the iron compounds. Constipation is not so likely to follow its administration as from other chalybeate preparations. Dose, 5 to 20 grains, in solution, before meals.

FERRI ET QUININÆ CITRAS (U. S. P)—IRON AND QUININE CITRATE.

SYNONYMS: *Ferri et quiniæ citras*, *Citras ferrico-quinicus*.

Preparation.—"Ferric citrate, eighty-five grammes (85 Gm.) [3 ozs. av.]; quinine, dried at 100° C. (212° F.), to a constant weight, twelve grammes (12 Gm.) [185 grs.]; citric acid, three grammes (3 Gm.) [46 grs.]; distilled water, a sufficient quantity to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Dissolve the ferric citrate in one hundred and sixty cubic centimeters (160 Cc.) [5 fl℥, 197 ♏] of distilled water, by heating on a water-bath, at a temperature not exceeding 60° C. (140° F.). To this solution add the quinine and citric acid, previously triturated with twenty cubic centimeters (20 Cc.) [325 ♏] of distilled water, and stir constantly until the quinine and citric acid are dissolved. Lastly, evaporate the solution, on a water-bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stoppered bottles, protected from light"—(*U. S. P.*).

The process employed by the *British Pharmacopœia* is complicated, and the salt, in consequence of the use of ammonia in its preparation, is much more soluble than that of the *U. S. P.*

Description and Tests.—Citrate of iron and quinine varies in solubility and color (yellow-green to brown-red), according to the method of producing it. The salt of the *British Pharmacopœia* has a greenish, golden-yellow hue. The official salt of the *U. S. P.* has never been in great demand on account of its slow solubility, the *soluble iron and quinine citrate* being preferred (see *Ferri et Quininæ Citras Solubilis*). The salt should not be exposed to sunlight.

"Thin, transparent scales, of a reddish-brown color, without odor, and having a bitter, mildly ferruginous taste; slowly deliquescent in damp air. Slowly but completely soluble in cold water, more readily soluble in hot water, and but partially soluble in alcohol. Its solubility is diminished by age. When strongly heated the salt chars, and finally leaves a residue of ferric oxide, which should not have an alkaline reaction upon litmus paper (absence of citrates or tartrates of the fixed alkalies). The aqueous solution of the salt has an acid reaction. On the addition of a slight excess of ammonia water the color of the solution is deepened, and a white, curdy precipitate is produced. The filtrate from this precipitate does not afford a blue color with potassium ferrocyanide T.S., unless it be acidulated with hydrochloric acid. Another portion of the filtrate, treated with an excess of potassium or sodium hydrate T.S., deposits a brownish-red precipitate. If a 10 per cent solution of the salt be deprived of its iron and quinine by boiling it with an excess of potassium or sodium hydrate T.S., and the filtrate slightly acidulated with acetic acid, a portion of the cooled liquid, mixed with a little calcium chloride T.S., and again heated to boiling, gradually deposits a white, crystalline precipitate. Another portion of the acidulated and cooled liquid, when allowed to stand for some time, should not deposit a white, crystalline precipitate (absence of tartrate)"—(*U. S. P.*).

Estimation of the Quinine.—"Dissolve 1.12 (1.1176) Gm. of iron and quinine citrate in a capsule, with the aid of a gentle heat, in 20 Cc. of water. Transfer the solution, together with the rinsings of the capsule, to a separator, allow the liquid to become cold, then add 5 Cc. of ammonia water and 10 Cc. of chloroform, and shake. Allow the liquids to separate, draw off the chloroform layer, and shake the residuary liquid a second and a third time with 10 Cc. of chloroform. Allow the combined chloroformic extracts to evaporate spontaneously, in a tared capsule, and dry the residue at a temperature of 100° C. (212° F.), to a constant weight. This residue should weigh not less than 0.1288 Gm. (corresponding to at least 11.5 per cent of dried quinine), and should conform to the reactions and tests of quinine (see *Quinina*)"—(*U. S. P.*).

Estimation of the Iron.—"Heat the aqueous liquid, from which the quinine has been removed in the manner just described, on a water-bath, until the odor of chloroform and ammonia has disappeared, allow it to cool, and dilute it with water to the volume of 50 Cc. Transfer 25 Cc. of the liquid to a glass-stoppered bottle (having the capacity of about 100 Cc.), add 2 Cc. of hydrochloric acid and 1 Gm. of potassium iodide, and allow the mixture to stand for half an hour at a temperature of 40° C. (104° F.). After it has been allowed to cool, and been mixed with a few drops of starch T.S., it should require about 14.5 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 1 per cent of metallic iron)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—A valuable tonic, useful in all cases where iron and quinine are indicated, and especially in the *anemia* following *malarial fevers*. Dose, 5 to 10 grains, in solution or pill, repeated 3 times a day.

Related Compound.—Ferri et Quininæ Citras cum Strychnina, *Iron and quinine citrate with strychnine, Ferri et quininæ strychninæque citras*. Take of citrate of iron and quinine, 490 grains; crystals of strychnine, citric acid, each, 5 grains; water, 5 fluid ounces. Dissolve the citrate of iron and quinine in 4½ fluid ounces of the water, and, having dissolved the strychnine and citric acid in the remaining ½ fluid ounce of water by boiling, mix the solutions, evaporate to a syrupy consistence, and spread on glass plates to dry in scales. One grain of strychnine, 20 grains of quinine, and 79 grains of citrate of iron, are contained in each 100 grains of this preparation. The scales exactly resemble those of citrate of iron and quinine, but have a more persistently bitter taste. The presence of strychnine may be detected in the residue from the evaporation of the chloroformic solution of the alkaloids by the usual color tests. This may be used in all cases of *nervous debility*, *anemia*, *chlorosis*, *dyspepsia*, *torpor of liver*, *constipation*, etc., in which the use of iron, quinine, and strychnine is indicated; it, together with the one later to be described (*Ferri et Strychninæ Citras*), is the safest, if not the best, means of exhibiting strychnine. Five grains of the preparation contain $\frac{1}{20}$ of a grain of strychnine. The dose is from 2 to 5 grains, 2 or 3 times a day.

FERRI ET QUININÆ CITRAS SOLUBILIS (U. S. P.)—SOLUBLE IRON AND QUININE CITRATE.

Preparation.—"Ferric citrate, eighty-five grammes (85 Gm.) [3 ozs. av.]; quinine, dried at 100° C. (212° F.), to a constant weight, twelve grammes (12 Gm.) [185 grs.]; citric acid, three grammes (3 Gm.) [46 grs.]; ammonia water, distilled water, each, a sufficient quantity to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Dissolve the ferric citrate in one hundred and sixty cubic centimeters (160 Cc.) [5 fl℥, 197 ♏] of distilled water, by heating on a water-bath at a temperature not exceeding 60° C. (140° F.). To this solution add the quinine and citric acid, previously triturated with twenty cubic centimeters (20 Cc.) [325 ♏] of distilled water and stir constantly until the quinine and citric acid are dissolved. Then add gradually and with constant stirring, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏], or a sufficient quantity of ammonia water, so that, after the addition of each portion of the latter, the precipitated quinine will be redissolved and the liquid acquire a greenish-yellow tint. Lastly, evaporate the solution on a water-bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stoppered bottles, protected from light"—(*U. S. P.*). This salt became official in the *U. S. P.* of 1890.

Description and Tests.—"Thin, transparent scales, of a greenish, golden-yellow color, without odor, and having a bitter, mildly ferruginous taste; deliquescent in damp air. Rapidly and completely soluble in cold water, but only partially soluble in alcohol. When strongly heated, the salt chars, and finally leaves a residue of ferric oxide, which should not have an alkaline reaction upon litmus paper (absence of citrates or tartrates of the fixed alkalies). The aqueous solution of the salt has a slightly acid reaction. On the addition of a slight excess of ammonia water the color of the liquid is deepened, and a white, curdy precipitate is produced. If a portion of the filtrate from this precipitate be mixed with some potassium ferrocyanide T.S., it does not afford a blue color or precipitate, unless it be acidulated with hydrochloric acid. Another portion of the filtrate, treated with an excess of potassium or sodium hydrate T.S., gives a brownish-red precipitate. If a portion of the salt be heated with potassium or sodium hydrate T.S., vapor of ammonia will be evolved. If a 10 per cent solution of the salt be deprived of its iron and quinine by boiling it with an excess of potassium or sodium hydrate T.S., and the filtrate slightly acidulated with acetic acid, a portion of the cooled liquid, mixed with a little calcium chloride T.S., and again heated to boiling, will gradually deposit a white, crystalline precipitate. Another portion of the acidulated and cooled liquid, when allowed to stand for some time, should not give a white, crystalline precipitate (absence of tartrate). Soluble iron and quinine citrate, when assayed for quinine and iron by the method described under *Ferri et Quininæ Citras*, should respond to the requirements for the latter"—(*U. S. P.*).

This preparation differs from the preceding in its ready solubility owing to the ammonia used in its production. It is the salt that should be used in making solutions of iron and quinine citrate. The ammonia-free salt (*Ferri et Quininæ Citras*) is, however, better adapted for pills.

Action, Medical Uses, and Dosage.—Same as for *Ferri et Quininæ Citras*, which see.

FERRI ET STRYCHNINÆ CITRAS (U. S. P.)—IRON AND STRYCHNINE CITRATE.

SYNONYM: *Ferri et strychniæ citras* (*U. S. P.*, 1870).

Preparation.—"Iron and ammonium citrate, ninety-eight grammes (98 Gm.) [3 ozs. av., 200 grs.]; strychnine, one gramme (1 Gm.) [15.4 grs.]; citric acid, one gramme (1 Gm.) [15.4 grs.]; distilled water, one hundred and twenty cubic centimeters (120 Cc.) [4 fl℥, 28 ♏], to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Dissolve the iron and ammonium citrate in one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of distilled water, and the strychnine, together with the citric acid, in twenty cubic centimeters (20 Cc.) [325 ♏] of distilled water. Mix the two solutions, evaporate the mixture by means of a water-bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of a syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in well-stoppered bottles, protected from the light"—(*U. S. P.*).

This preparation is merely a mixture of ammonio-ferric citrate and strychnine citrate. It should not be prescribed in solution, as Dr. E. R. Squibb has shown (*Ephemeris*, 1888), that it rapidly decomposes, even in a few hours, throwing down a white deposit. Strychnine, to the extent of 50 per cent, was found in this sediment, hence the danger of using it in solution. If it must be used in this manner the liquid should be well shaken before taking each dose. It may be given in pill form. The salt should contain about 1 per cent of strychnine.

Description.—"Thin, transparent scales, varying in color from garnet-red to yellowish-brown, without odor, and having a bitter, slightly ferruginous taste; deliquescent in damp air. Readily and completely soluble in water, but only partly soluble in alcohol. When strongly heated, the salt chars, and finally leaves a residue of ferric oxide, which should not have an alkaline reaction upon litmus paper (absence of citrates or tartrates of the fixed alkalies). The aqueous solution of the salt is slightly acid to litmus paper, and is not immediately precipitated, but rendered darker in color, by ammonia water. With potassium ferrocyanide T.S., it does not yield a blue color or precipitate, unless it be acidulated with hydrochloric acid. On heating it with potassium or sodium hydrate T.S., a brownish-red precipitate is produced, and vapor of ammonia evolved. If a 10 per cent solution of the salt be deprived of its iron and strychnine by boiling it with an excess of potassium or sodium hydrate T.S., and the filtrate slightly acidulated with acetic acid, a portion of the cooled liquid mixed with a little calcium chloride T.S., and again heated to boiling, will gradually deposit a white, crystalline precipitate. Another portion of the acidulated and cooled liquid, when allowed to stand for some time, should not deposit a white, crystalline precipitate (absence of tartrate)"—(*U. S. P.*).

Estimation of the Strychnine.—"Dissolve 2.24 (2.2352) Gm. of iron and strychnine citrate, in a separator in 15 Cc. of water, add 5 Cc. of ammonia water, and 10 Cc. of chloroform, and shake. Allow the liquids to separate, draw off the chloroform layer, and shake the residuary liquid a second and a third time with 10 Cc. of chloroform. Allow the combined chloroformic extracts to evaporate spontaneously in a tared capsule, and dry the residue at a temperature of 100° C. (212° F.), to a constant weight. This residue should weigh not less than 0.02 Gm. nor more than 0.0224 Gm. (corresponding to not less than 0.9 nor more than 1 per cent of strychnine), and should respond to the reactions and tests of strychnine (see *Strychnina*)"—(*U. S. P.*).

Estimation of the Iron.—"Heat the aqueous liquid, from which the strychnine has been removed in the manner just described, on a water-bath, until the odor of chloroform and ammonia has disappeared, allow it to cool, and dilute it with water to the volume of 100 Cc. Transfer 25 Cc. of the liquid to a glass-stoppered bottle (having the capacity of about 100 Cc.), add 2 Cc. of hydrochloric acid and 1 Gm. of potassium iodide, and allow the mixture to stand for half an hour, at a temperature of 40° C. (104° F.). After it has been allowed to cool, and been mixed with a few drops of starch T.S., it should require about 16 Cc. of decinormal sodium hyposulphite V.S., to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 1 per cent of the metallic iron)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This preparation is useful in *debility*, *dyspepsia* arising from atony, *chlorosis*, *chorea*, *suppressed menstruation*, etc. Five grains contain $\frac{1}{20}$ of a grain of strychnine. The dose is from 1 to 4 grains in pill, cautiously increased to 6 grains, 2 or 3 times a day. It should not be given in solution.

FERRI FERROCYANIDUM.—FERRIC FERROCYANIDE.

Formula: $Fe_7Cy_{18} = Fe_7(CN)_{18} = Fe_4(FeCy_6)_6 = Fe_4 3Fe(CN)_6$. Molecular Weight: 858.8.

Synonyms: *Prussian blue, Paris blue, Williamson's blue, Ferrocyanide of iron, Ferrocyanuret of iron, Ferri ferrocyanuretum, Insoluble Prussian blue, Ferrum ferrocyanatum, Ferrum borussicum, Ferrum zooticum, Cœruleum borussicum, Cyanuretum ferrosoferricum, Ferrocyanidum ferricum.*

Preparation.—This is formed by precipitating a solution of ferrocyanide of potassium (yellow prussiate of potash, $Fe_2Cy_{12}K_8$ or $2FeCy_6K_4$), with a solution of ferric sulphate or ferric chloride in excess. The *U. S. P.*, of 1870, directed potassium ferrocyanide, 9 troy ounces; solution of ferric sulphate, 1 pint; water, 3 pints. The potassium salt to be dissolved in 2 pints of the water, and the iron solution in 1 pint. Add the solution of the potassium salt gradually with constant stirring, to the iron solution, filter, and wash the blue precipitate with boiling water, dry, and powder the product. The following reaction takes place: $3Fe_2Cy_{12}K_8+4Fe2Cl_6=24KCl+2Fe_4(FeCy_6)_3$. To free the compound from adherent potassium salt considerable washing is required. It retains about 18 molecules of H_2O when dried at a temperature near 40° C. (104° F.), but on subjecting it to a higher heat this is gradually dissipated.

Description.—Prussian blue, when well made, is of a beautiful dark-blue color, without taste or odor. The broken surfaces of the fragments are of a beautiful bronze color, and the compound when triturated, yields a handsome deep-blue powder. It is not dissolved by water, alcohol, ether, oils, or diluted acids. It is decomposed by the concentrated acids, with a variety of phenomena. The alkalies also decompose it, forming solution of ferrocyanides and a precipitate of ferric hydroxide. Heated in the air, it burns slowly, leaving ferric oxide and earthy matters if any are present. Oxalic and other organic acids dissolve it, forming a beautiful deep-blue solution, the solution in the former being called *Washing-blue*, and is often known as *Soluble Prussian blue* (not to be confused with the *True soluble Prussian blue* of Berzelius, for which, see *Ferric Potassium Ferrocyanide*). When Prussian blue is boiled with diluted hydrochloric acid, filtered, and ammonia added to it, no precipitation of hydroxides of aluminum, lead, etc., nor blue coloration (due to copper), takes place if the drug be pure.

Action, Medical Uses, and Dosage.—Prussian blue is tonic, sedative, and febrifuge; and was introduced as a remedy in *periodic diseases*, in conjunction with sulphate of quinine, by the late Prof. I. G. Jones, who used it with great success in the treatment of these diseases. He did not regard the febrile or inflammatory symptoms as contraindicating its use, provided the disease was, in the least degree, of a periodical character. It has been successfully used in *intermittent*, *congestive*, *bilious*, and *typhoid fevers*, especially during the remissions, and also in *typhoid pneumonia;* the dose is 3 or 4 grains, combined with the same quantity of sulphate of quinine, to be repeated every 3, 4, or 5 hours, according to the nature of the case. Prussian blue has likewise been successfully used in *diarrhœa*, *summer complaint of children*, *pertussis*, *dyspepsia*, *epilepsy*, *hysteria*, *chorea*, and *facial neuralgia*. It is now seldom employed. The dose is usually from 1 to 5 grains, 3 times a day.

Related Compounds.—POTASSIUM FERRI-FERROCYANIDE ($K_2Fe^{vi}_2[C_3N_3]_4Fe^{iv}_2$.), *Ferric potassium ferrocyanide*. This is the *True soluble Prussian blue* of Berzelius, and is prepared by pouring a solution of ferric sulphate or chloride into a solution of potassium ferrocyanide *in excess*, and washing the precipitate to free it from sulphate or chloride of potassium or other foreign substances. The salt thus made will dissolve in pure water, but not in salt solutions; hence it is precipitated from its aqueous solution by various salts. It is not used in medicine (see Lloyd's *Chem. of Med.*).

POTASSIUM FERRO-FERRICYANIDE ($K_2Fe_2[Fe_2Cy_{12}]$), a soluble substance identical in composition with the foregoing, is produced when a solution of a ferrous salt is added to an excess of a solution of ferricyanide of potassium (red prussiate of potash).

FERRICYANIDUM FERROSUM ($Fe_3[Fe_2Cy_{12}]$), *Turnbull's blue, Ferrous ferricyanide.*—This is the blue precipitate produced when ferricyanide of potassium (red prussiate of potash) is added to the solution of a ferrous salt. The reaction is made use of in testing in order to distinguish between *ferrous* and *ferric* salts.

In this connection it is probably well to briefly recapitulate the color reactions that take place between ferro- and ferricyanide of potassium on the one hand, and ferrous and ferric salts on the other. Ferrocyanide and ferric salt, blue precipitate (soluble Prussian blue); ferrocyanide and ferrous salt, white precipitate, turning blue rapidly when exposed to the air; ferricyanide and ferrous salt, blue precipitate (Turnbull's blue); ferricyanide and ferric salt, brown solution.

FERRI HYPOPHOSPHIS (U. S. P.)—FERRIC HYPOPHOSPHITE.

FORMULA: $Fe_26(PH_2O_2)$. MOLECULAR WEIGHT: 501.04.

SYNONYMS: *Hypophosphite of iron, Ferrum hypophosphorosum, Hypophosphis ferricus.*

Preparation.—This preparation may be made by double decomposition between solution of ferric chloride or ferric sulphate, and solution of hypophosphite of sodium. If the ferric salt is free from excess of acid, the hypophosphite of iron will separate as a precipitate when the solutions are mixed, after which it may be washed with distilled water and then dried. Owing to a certain degree of solubility of the salt in water, however, much is lost in the washings. It is customary in practice to use *ferrous hypophosphite*, as a component of the popular pharmaceutical preparation, *Syrup of the Hypophosphites*. In this case the solution of ferrous hypophosphite is made by double decomposition between solution of hypophosphite of calcium and solution of ferrous sulphate (J. U. Lloyd, in *Chemistry of Medicines*). An acceptably pure ferric hypophosphite may be prepared according to Mr. F. X. Moerk, by dissolving in a flask calcium hypophosphite (30 Gm. = 1 oz. av., 25 grs.) in distilled water (100 Cc. = 3 fl℥, 183 ♏). Gradually add solution of ferric chloride (49.5 Gm. = 1 oz. av., 326 grs.). Agitate well as each portion is added. After allowing the mixture to stand for 3 days, frequently shaking it, filter and wash the precipitate well. This process is based upon the observation that the flocculent precipitate of ferric hypophosphite becomes crystalline upon prolonged standing. In this condition it is less soluble in water, and can thus be conveniently washed without much loss (*Amer. Jour. Pharm.*, 1889, p. 393).

The *National Formulary* directs as follows: "*Formulary number*, 183: FERRI HYPOPHOSPHIS (N. F.), *Hypophosphite of iron, Ferric hypophosphite.*—Iron and ammonium sulphate (*U. S. P.*), in perfect crystals, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; sodium hypophosphite, sixty-seven grammes (67 Gm.) [2 ozs. av., 159 grs.]; distilled water, a sufficient quantity. Dissolve the iron and ammonium sulphate in four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏], and the sodium hypophosphite in one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏] of distilled water, and, if necessary, filter each solution. Then mix them, and stir thoroughly; after a short time transfer the mixture to a close linen or muslin strainer, and wash the precipitate with distilled water, until the washings run off tasteless. Transfer the strainer to a warm place and when the contents are dry, preserve them for use. Hypophosphite of iron (ferric) may also be prepared in the following manner:

"Calcium hypophosphite, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; solution of chloride of iron (*U. S. P.*), distilled water, of each, a sufficient quantity. Dissolve the calcium hypophosphite in twelve hundred cubic centimeters (1200 Cc.) [40 fl℥, 277 ♏] of distilled water, and filter the solution. To this add solution of chloride of iron, in small portions, stirring well each time, and allowing the precipitate to subside before adding a fresh portion. Toward the end, remove a small quantity of the clear supernatant liquid, add to it some solution of chloride of iron diluted with ten times its volume of water, and observe whether any turbidity occurs either at once or after a few minutes. If it remains clear, the precipitation may be regarded as complete. Then transfer the mixture to a close linen or muslin strainer, and wash the precipitate with distilled water until the washings run off tasteless. Transfer the strainer to a warm place, and, when the contents are dry, preserve them for use. *Note.*—Hypophosphite of iron is rendered soluble in water by mixing it with about an equal weight of potassium citrate, or some other alkali citrate. Theoretically, 100 grammes of iron and ammonium sulphate will yield 51.9 grammes, and 100 grammes of calcium hypophosphite will yield 85.3 grammes of dry hypophosphite of iron (ferric)"—(*Nat. Form.*).

Description and Tests.—The *U. S. P.* describes hypophosphite of iron as "a white or grayish-white powder, odorless and nearly tasteless; permanent in the air. Only slightly soluble in water, more readily in the presence of hypophosphorous acid, or in a warm, concentrated solution of an alkali citrate, forming with the latter a green solution. When strongly heated in a dry test-tube, the salt evolves spontaneously inflammable hydrogen phosphide gas, and, on complete ignition, leaves a residue of ferric pyrophosphate. The salt is readily oxidized by nitric acid or other oxidizing agents. If to 0.5 Gm. of the salt 5 Cc. of acetic acid be added, no effervescence should occur (absence of carbonate), and if the mixture be subsequently heated to boiling, the filtrate, upon cooling, should afford no turbidity with ammonium oxalate T.S. (absence of calcium). If 0.5 Gm. of the salt be boiled with 10 Cc. of potassium or sodium hydrate T.S., a reddish-brown precipitate will be produced; and if to the filtrate from the latter, slightly acidulated with hydrochloric acid, magnesia mixture be added, and subsequently an excess of ammonia water, no crystalline precipitate should be produced (absence of phosphate). If 1 Gm. of ferric hypophosphite be mixed with 10 Cc. of water, then 10 Cc. of diluted sulphuric acid and 50 Cc. of decinormal potassium permanganate V.S. added, and the mixture boiled for 15 minutes, it should require not more than 3 Cc. of decinormal oxalic acid V.S. to discharge the red color (corresponding to at least 98.1 per cent of the pure salt)"—(*U. S. P.*).

"Ferric hypophosphite should be kept in well-stoppered bottles"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This salt is preferably administered in syrup, though it may be given in pill or powder. It is used in *anemic states* associated with cerebral enfeeblement. Dose, 5 to 10 grains.

FERRI IODIDUM SACCHARATUM (U. S. P.)—SACCHARATED FERROUS IODIDE.

FORMULA (Ferrous iodide): FeI_2. MOLECULAR WEIGHT: 308.94.

SYNONYMS: *Ferrum iodatum saccharatum, Saccharated iodide of iron.*

Preparation.—"Take of iron, in the form of fine, bright wire, and cut into small pieces, six grammes (6 Gm.) [93 grs.]; reduced iron, one gramme (1 Gm.) [15.5 grs.]; iodine, seventeen grammes (17 Gm.) [262 grs.]; distilled water, sugar of milk, recently dried, each, a sufficient quantity to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Mix the iron wire, iodine, and twenty cubic centimeters (20 Cc.) [325 ♏] of distilled water in a flask of thin glass, shake the mixture occasionally, until the reaction ceases, and the solution has acquired a green color and lost the smell of iodine; then filter it through a small wetted filter into a porcelain capsule containing forty grammes (40 Gm.) [1 oz. av., 180 grs.] of sugar of milk. Rinse the flask and iron wire with a little distilled water, pass the rinsings through the filter into the capsule, and evaporate on a water-bath, with frequent stirring, until a dry mass remains. Transfer this quickly to a heated iron mortar, reduce it to powder, and mix it intimately, by trituration, with the reduced iron and enough sugar of milk to make the final product weigh one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Transfer the powder at once to small and perfectly dry bottles, which should be securely stoppered, and kept in a cool and dark place"—(*U. S. P.*).

This preparation should contain 20 per cent of ferrous iodide. Iron and iodine react upon each other with the production of heat, yielding ferrous iodide (FeI_2). The water merely acts as a solvent of the product, and to mitigate the violence of the reaction. Volatilization of iodine should be checked by immersion of the flask in cold water. On the other hand, should the reaction take place too slowly toward the close of the operation, a gentle heat may be applied. Some prefer to add the ingredients fractionally, and not all at one time, as directed in the official process. To do this the water and iodine may be placed in the flask, and the iron added gradually, allowing the reaction to nearly complete itself before adding a fresh portion. The object in adding the reduced iron at the close of the operation is to preserve the preparation, as, if any iodine is subsequently liberated, the iron will unite with it.

Description and Tests.—"A yellowish-white or grayish, very hygroscopic powder, without odor, and having a sweetish, ferruginous taste. Soluble in 7 parts of water at 15° C. (59° F.), forming a nearly clear solution, but only partially soluble in alcohol. When strongly heated, the compound swells up, evolves the odor of iodine and of burning sugar, and, on complete ignition, leaves a residue which should yield nothing soluble to water (absence of the salts of the fixed alkalies). The aqueous solution has a slightly acid reaction, and gives with potassium ferricyanide T.S. a blue precipitate. If the aqueous solution be mixed with a little starch T.S., and afterward with a few drops of chlorine water, it will assume a deep-blue color. This color should not be developed in the aqueous solution by starch T.S. alone (absence of free iodine). If 1.55 (1.5447) Gm. of saccharated ferrous iodide be dissolved in about 20 Cc. of water, in a small flask, and to this solution be successively added, first, 22 Cc. of decinormal silver nitrate V.S., then 5 Cc. of diluted nitric acid and 5 Cc. of ferric ammonium sulphate T.S., it should not require more than 2 Cc. of decinormal potassium sulphocyanate V.S. to produce a reddish-brown tint which persists after shaking (corresponding to about 20 per cent of pure ferrous iodide)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—The action and uses of saccharated iodide of iron are identically those of ferrous iodide. The influence of iodide of iron upon the system resembles that caused by the ferruginous salts more than that occasioned by iodine. As a tonic it improves the appetite, invigorates the digestive organs, and blackens the alvine evacuations, diminishing their offensive odor. Sometimes it acts as a laxative, but more generally as a diuretic. It is also tonic, alterative, and emmenagogue. It has been efficiently used in *scrofula, chlorosis, secondary syphilis, amenorrhœa, chronic rheumatism, chronic cutaneous diseases, fluor albus, asthenic dropsy, old visceral engorgements, atonic dyspepsia*, and in all cases where there is torpor in the system of nutrition, where there is paucity of red globules in the blood, and the fluid is too thin. On account of its tendency to decomposition when exposed to the air, it should always be given in solution or syrup (see *Liquor Ferri Iodidi* and *Syrupus Ferri Iodidi*). In the *anemia of scrofula, phthisis*, etc., it imparts strength, improves the appetite and digestion, and increases secretion. Here the syrup should be given with cod-liver oil. It has been given with marked success in *hydrocephalus*, and in *dysmenorrhœa*, and in *anemic scrofulous females*. From 5 to 10 drops of the syrup, 3 times a day, relieves the *incontinence of urine* in anemic children. Iodide of iron has, however, been given in pill form, being protected from deleterious agencies by the addition of gum and sugar, or tragacanth and honey (see *Amer. Jour. Pharm.*, XV., 71, and CIII., 138). The liquor ferri iodidi, evaporated to a proper consistence for making pills, would probably form a better mode of administering this salt in a solid state, than when made by the above process (see *Pilulæ Ferri Iodidi*). The dose of iodide of iron is 3 grains, gradually increased to 8 or 10 grains, 3 times a day.

Related Preparations.—Ferri Iodidum, *Ferrous iodide, Ioduretum ferrosum, Iodide of iron.* Take of iodine, 2 ounces and 2 drachms; pure iron filings, 6 drachms; distilled water, cold, 4½ fluid ounces. By a former method, the iodine was mixed with the water, and the iron filings gradually added, with constant stirring of the mixture. This was then heated until it acquired a greenish hue, filtered, and evaporated to dryness in an iron vessel.

Messrs. T. and H. Smith subsequently directed as follows: Put the aforementioned ingredients into a flask, boil till the liquid loses its dark color, then filter it rapidly into another clean flask, and, without delay, place the flask over the flame of a gas-burner, and evaporate the liquid at a boiling heat. The ebullition is allowed to proceed until the liquid passes from a green shade into black. The iodide may now be obtained either as a crystallized hydrate, or in an amorphous anhydrous form; first, as a *crystallized hydrate* (FeI_2+4H_2O), by dipping an iron wire or glass rod into the liquid in the flask at short intervals, till, on removing and cooling, the iodide is found to form a dry and hard crust on the rod. When the evaporation has reached this point, remove the flask from the fire, and the fused iodide will crystallize on cooling. To obtain the *anhydrous iodide*, the evaporation must be carried still further. The period for bringing the application of heat to a close, may be judged of by occasionally placing a piece of cold glass over the mouth of the flask, and suspending the heat when moisture ceases to be condensed on the glass. A pure anhydrous, spongy, ferrous iodide will then be found in the flask, and may be removed by breaking the container. The compound should, without the least delay, be coarsely bruised in a warm, dry mortar, and then placed in small bottles and well corked (T. and H. Smith).

Iodide of iron is a dry, greenish-gray or greenish-black, crystalline mass, odorless, and of a sweetish, astringent taste, somewhat resembling iodine. Water or alcohol forms with it, when freshly made, a greenish solution having an acid reaction; in the air, on being kept, it deliquesces, forming ferric oxide and ferric iodide, and will not be wholly soluble, forming a yellow or brown solution. Gently warmed it melts, and by a further action of heat, water, and air, continually evolves iodine vapors, and leaves a grayish-brown mass, consisting of ferrous iodide, ferric iodide, and ferric oxide. If the dried mass be heated to redness, all the iodine is given off, and the iron remains as oxide. As regards the keeping qualities of this substance, see *Syrupus Ferri Iodidi.* The salt is *incompatible* with vegetable astringents, sodium, potassium hydroxide, and other alkalies, liquor calcis, metallic salts, etc.

Dupasquier's Paste.—Considerable use has been made of Dr. Dupasquier's paste, or pills of protiodide of iron (ferrous iodide); it is prepared as follows: Take of iodine, 121 grains; iron, 242 grains; distilled water, 378 grains. Introduce the whole into a small flask, which should be plunged during 8 or 10 minutes in water warmed to about 75° C. (167° F.), so that no portion of the iodine shall be volatilized. Agitate the mixture frequently. At first the liquid becomes brown, but soon becomes perfectly colorless, or, at most, retains a nearly imperceptible green hue. Filter rapidly, and pour the solution into an untinned iron vessel; add pure honey, 302 grains; evaporate rapidly, until a syrupy consistence is attained; then add at intervals, continually agitating with an iron spatula, powder of gum tragacanth, 184 grains. Form into a mass, and divide into 200 pills; each pill contains about $\frac{3}{4}$ of a grain of protiodide of iron, and will remain a long time unaltered. BLANCARD'S PILLS are similar, but are sugar-coated as soon as made.

FERRIC IODATE, *Iodate of iron, Iodate of sesquioxide of iron* ($2Fe_2[IO_3]_6,Fe_2O_3.24H_2O$).—Add solution of ferric chloride (5 fluid drachms), to water (4 fluid ounces). Precipitate this solution with another solution composed of potassium iodate (1 ounce) in water (10 fluid ounces). The precipitate is tasteless, does not attack the teeth, and has been recommended to take the place of iodide of iron.

FERRI LACTAS (U. S. P.)—FERROUS LACTATE.

FORMULA: $Fe(C_3H_5O_3)_2+3H_2O$. MOLECULAR WEIGHT: 287.34.

SYNONYMS: *Lactate of iron, Lactas ferrosus.*

Preparation.—The *U. S. P.* (1870) process consists in digesting a solution of lactic acid (1 ounce) in distilled water (1 pint) with iron filings ($\frac{1}{2}$ ounce) until the reaction ceases; filter into a porcelain vessel and crystallize. Evaporate the mother liquor to one-half in an iron vessel, filter hot, and set aside to obtain additional crystals. The following process is based upon the double decomposition ensuing between calcium lactate and ferrous sulphate: Take of calcium lactate, 12$\frac{1}{2}$ ounces; pure crystallized ferrous sulphate, 8$\frac{1}{2}$ ounces; boiling water, cold distilled water, of each, 62$\frac{1}{2}$ ounces, by weight; lactic acid, a sufficient quantity. Dissolve the lactate of calcium in the boiling water; also dissolve the sulphate of iron in the cold distilled water; then filter each of these solutions, mix them in a vessel; feebly acidulate the mixture with lactic acid, and heat in a salt-water bath, constantly stirring until the completion of the double decomposition. The sulphate of calcium formed is to be removed by filtering, and the filtrate is to be quickly reduced to one-half by evaporation in an iron vessel (or, if porcelain be used, some iron filings must be added). Filter the concentrated liquid, and, on cooling, it forms crystals of lactate of iron, which should be washed with alcohol, and dried on bibulous paper (Lepage).

Lactate of iron was introduced to the profession by Gélis and Conté.

Description.—"Pale, greenish-white crusts, consisting of small, needle-shaped crystals, having a slight, peculiar odor, and a mild, sweetish, ferruginous taste. Slowly but completely soluble in 40 parts of water at 15° C. (59° F.), and in 12 parts of boiling water; freely soluble in a solution of an alkali citrate, yielding a green solution; almost insoluble in alcohol. When strongly heated, the salt froths up, gives out dense, white, acrid fumes, chars, and finally leaves a brownish-red residue. The aqueous solution of the salt has a greenish-yellow color, a slightly acid reaction, and gives with potassium ferricyanide T.S. a deep blue, and with potassium ferrocyanide T.S. a light blue precipitate"—(*U. S. P*).

Tests.—"A 2 per cent aqueous solution of the salt should not afford with lead acetate T.S., nor, after acidulation with hydrochloric acid, with hydrogen sulphide T.S., more than a whitish opalescence (limit or absence of sulphate, chloride, citrate, tartrate, malate, etc., and of foreign metals). The aqueous solution, acidulated with nitric acid, should not afford more than a slight opalescence with barium chloride T.S., or with silver nitrate T.S. (limit of sulphate or chloride). If 25 Cc. of the aqueous solution (1 in 50), mixed with 5 Cc. of diluted sulphuric acid, be boiled for a few minutes, then precipitated by an excess of potassium or sodium hydrate T.S., the filtrate, mixed with a few drops of alkaline cupric tartrate V.S., and heated to boiling, should not afford a red precipitate (absence of sugar). If a portion of the salt be triturated with strong sulphuric acid, no offensive odor should be developed (absence of butyric acid), nor should any gas be evolved (absence of carbonate), and the mixture, after standing for some time, should not assume a brown color (absence of sugar, gum, or other readily carbonizable impurities). If 1 Gm. of the salt, contained in a porcelain crucible, be moistened with nitric acid, and carefully ignited, it should leave a residue of ferric oxide weighing not less than 0.270 nor more than 0.278 Gm. This residue should not have an alkaline reaction upon litmus paper, nor yield anything soluble to water (absence of foreign salts)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Lactate of iron has been found efficient in *anemia*, *amenorrhœa*, *dysmenorrhœa*, and other diseases in which the preparations of iron are usually of service. The dose is from 1 to 3 grains, gradually increased and repeating it at periods of 3 or 4 hours. As it is not superior to other chalybeates, its costliness will probably prevent it from coming into general use

FERRI OXIDUM HYDRATUM (U. S. P.)—FERRIC HYDRATE.

FORMULA: $Fe_2(OH)_6$. MOLECULAR WEIGHT: 213.52.

SYNONYMS: *Ferric hydroxide, Hydrated oxide of iron, Hydrated sesquioxide of iron, Moist peroxide of iron, Ferri peroxidum.*

Preparation.—"Solution of ferric sulphate, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; ammonia water, one hundred and ten cubic centimeters (110 Cc.) [3 fl℥, 345 ♏]; water, a sufficient quantity. To the ammonia water, previously diluted with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of cold water, add, under constant stirring, the solution of ferric sulphate, previously diluted with one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of cold water. As soon as the precipitate has subsided, draw off the clear liquid by means of a siphon, then mix the precipitate intimately with about one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of cold water, again draw off the clear liquid after subsidence of the precipitate, and repeat this operation, until a portion of the decanted liquid gives not more than a slight cloudiness with barium chloride test-solution. Finally transfer the precipitate to a wet muslin strainer, and, after it has drained, mix it with sufficient cold water to make the mixture weigh two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.].

"When ferric hydrate is to be made in haste, for use as an antidote, the washing may be performed more quickly, though less perfectly, by transferring the precipitate at once to a wet muslin strainer, pressing forcibly with the hands, until no more liquid passes, and then adding enough water to make the whole weigh about two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.].

Note.—"The ingredients for preparing ferric hydrate as an antidote should always be kept on hand in bottles containing, respectively, two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of the solution of ferric sulphate, and two hundred and twenty cubic centimeters (220 Cc.) [7 fl℥, 211 ♏] of ammonia water. Ferric hydrate, thus prepared, is a brownish-red magma, wholly soluble in hydrochloric acid without effervescence"—(*U. S. P.*).

While the *U. S. P.* process directs the use of ammonia as a precipitant, that of *Br. Pharm.* directs solution of soda. The resulting preparation in the first instance is a tasteless, brown-red magma, while that of the latter is directed to be a tasteless, non-magnetic, brownish-red powder, containing but 10 per cent of moisture. Probably magnesia, which in itself has some antidotal power over arsenic, is a better precipitant than either ammonia or soda solution, when the preparation is to be used as an antidote (see next article, *Ferri Oxidum Hydratum cum Magnesia*). Two precautions must be observed in regard to the *U. S. P.* product if the preparation is to possess antidotal properties: First—*Heat* should be avoided in its preparation, the product being most effective when made at the ordinary temperature. Secondly—It should be *recently prepared*, and the magma, when rubbed with water, should be non-granular, forming a smooth mass readily and completely soluble in both acetic and hydrochloric acids, without effervescing, otherwise it refuses to unite with arsenous acid. Ferric hydroxide (*U. S. P.*) unites readily with the weaker acids, and has the important property of forming an insoluble compound with arsenous acid. If dried, in consequence of the loss of a portion of its water, it becomes an oxyhydrate ($Fe_2O_2[OH]_2$) of a reddish color, and incapable of uniting with arsenous acid; hence it is then of no value as an antidote to that poison. It has been proposed to keep the magma under water in order to retard this change, but even then, in a little time, it loses half of its combined water and becomes changed to a brick-red ferric oxyhydrate ($Fe_2O_3.Fe_2[OH]_6$). Excessive heat or freezing produces similar results. The small amount of ammonium sulphate remaining in the oxide, when prepared hurriedly as before directed, in a case of poisoning, is not objectionable. When the oxide is intended for the preparation of other ferruginous compounds, as, for instance, citrate of iron, it should be washed by displacement on a cloth filter, till the washings cease to be precipitated by chloride of barium.

Description.—Ferric hydroxide, as prepared by the above process, is a soft magma of a reddish-brown tint, practically odorless and tasteless, insoluble in water, but dissolving readily in hydrochloric acid, forming a golden-yellow solution. Heated to redness, it loses its water, and then combines with difficulty with arsenous acid. Effervescence with hydrochloric acid, indicates the presence of carbon dioxide; when the solution in hydrochloric acid is precipitated by ammonia water and the precipitate filtered, oxalate of ammonium will cause a precipitate in the filtrate if calcium be present. If the solution in hydrochloric acid gives a blue precipitate with ferricyanide of potassium, it contains ferrous oxide; if, after dissolving it in hydrochloric acid, there is a white, gelatinous residue, soluble in caustic potash, it is silica, arising from its probably being made with potassium hydroxide containing silica instead of with ammonia. An excess of ammonia water strikes a blue color when oxide of copper is present; should the color not be clear, supersaturate with acetic acid, and add solution of ferrocyanide of potassium, which causes a brownish-red precipitate if the smallest trace of copper be present.

Action, Medical Uses, and Dosage.—This agent is unfitted for the same therapeutical applications as the other iron compounds. It is, however, universally accepted as the antidote to be employed in cases of *arsenical poisoning*. Probably the ferrous arsenate acts by enveloping the particles of acid, thus rendering them insoluble, and preventing their absorption until an emetic may be administered or the stomach pump used. It may be given freely in tablespoonful doses every 5 or 10 minutes, followed by means to evacuate the stomach.

Related Oxides.—Ferri Peroxidum Hydratum ($Fe_2O_3.H_2O$, or $Fe_2O_2[OH]_2$). Molecular Weight: 177.60. *Ferric oxyhydrate, Hydrous peroxide of iron, Ferrum oxydatum fuscum, Ferric hydricum, Oxydum ferricum hydratum, Rubigo, Ferrugo.* This deep reddish-brown powder is obtained by drying the moist ferric hydrate (hydroxide) at a heat not above 100° C. (212° F.). It contains about 10 per cent of moisture. It should completely dissolve in diluted hydrochloric acid without effervescence. Heated to dull redness in a test tube it gives off moisture (*Br. Pharm.*, 1867). It is scarcely soluble in acetic acid. The *brown hematites*, occuring in nature as minerals, are composed of ferric hydroxides.

Ferri Oxidum Nigrum, *Black oxide of iron* (Fe_3O_4 or $FeO.Fe_2O_3$), *Ferri oxidum magneticum, Magnetic oxide of iron, Ferroso-ferric oxide, Ferrum oxydatum magneticum, Ethiops martial, Martial Ethiops, Oxydum ferroso-ferricum.*—Take of sulphate of iron, 6 ouuces; sulphuric acid (commercial), 2½ fluid drachms; pure nitric acid, 4½ fluid drachms; stronger aqua ammoniæ, 4½ fluid drachms; boiling water, 3 pints. (The above fluid measures are Imperial). Dissolve half the sulphate in half the boiling water, and gradually add the sulphuric acid; boil; add the nitric acid by degrees, boiling the liquid after each addition briskly for a few minutes. Dissolve the rest of the sulphate in the remainder of the boiling water; mix the two solutions thoroughly, and immediately add the ammonia in a full stream, briskly stirring the mixture at the same time. Collect the black powder on a calico-filter; wash it with water till the water is scarcely precipitated by a solution of nitrate of barium. and dry it at a temperature not exceeding 82.2° C. (180° F.) (*Ed.*).

Black oxide of iron thus prepared forms a jet-black, or grayish-black mass, with a velvety appearance, and is attracted by the magnet. It is odorless and tasteless, dissolves in hydrochloric acid without effervescence and without a residue, from which yellowish solution it is precipitated by ammonia. Its hydrochloric solution gives the blue coloration with both ferro- and ferricyanides of potassium. It is converted by strong heat into *red ferric oxide*. The scales (*ferri squamæ*), which are struck from red-hot iron by the blacksmith's hammer, the *Æthiops martis* of the old Materia Medicas, consist of chemical combinations of the ferrous oxide and ferric oxide in variable proportions. They are prepared for medicinal use by washing them, freeing them from impurities by the magnet; triturating them, and separating the fine powder by the method directed for making prepared chalk. It is, however, inferior in medicinal virtue to the black oxide as prepared above. *Magnetic iron ore* (magnetic oxide) consists of ferric and ferrous oxides in molecular proportions. This is an excellent iron tonic, is not changeable when exposed to the atmosphere and dampness, is more readily soluble in the fluids of the stomach than the sesquioxide, and produces no local irritation. Dose, 5 to 20 grains.

Ferri Oxidum Rubrum, *Ferric oxide* (Fe_2O_3). Molecular weight: 159.68. *Ferri peroxydum. Ferri sesquioxidum, Peroxide of iron, Sesquioxide of iron, Caput mortuum, Crocus martis adstringens. Colcothar.*—Expose sulphate of iron to heat, until the water of crystallization is expelled. Then roast it by an intense fire so long as acid vapors arise. Wash the ferric oxide until the washings, when examined by litmus, appear free from acid. Lastly, dry it on bibulous paper (*Dub.*). In this process the water and sulphuric acid of the crystallized sulphate of iron are expelled; the iron is oxidized by the oxygen of the air and partly at the expense of a portion of the sulphuric acid, which is thereby reduced to sulphurous acid. M. A. Vogel recommends the following as a preferable method of preparing a red oxide of iron or colcothar, for polishing glass and metals, without any previous washing. Into a solution of sulphate of iron made with boiling water and filtered, a concentrated solution of oxalic acid is poured, until the yellow precipitate of oxalate of iron is no longer formed. When the liquor has entirely cooled and ceased to deposit, the precipitate is washed on a cloth with hot water until the water ceases to acquire an acid reaction. The oxalate of iron, not yet perfectly dry, is in the next place heated on a plate of iron over a charcoal fire or lamp. The decomposition of the salt commences at about 204.4° C. (400° F.), and at a temperature a little higher than this the red oxide of iron is formed in a very finely divided state.

Red oxide of iron is an odorless and tasteless, dark, crimson-red powder, not magnetic, insoluble in water, dissolved, but not readily, by hydrochloric acid without any gas being evolved, and forming a golden-yellow solution, which is not changed to blue by ferricyanide of potassium unless ferrous oxide is present. It is anhydrous, and has been called *Colcothar* and *Crocus martis adstringens.* This compound exists native mainly in the form of *hematite,* or *red hematite.* It is but little employed as a medicine at the present day, but is largely consumed in the arts. Colcothar in finely divided state, is used as a polishing powder for glass and metals under the name *polishing rouge*, or *polirroth.* The iron paints known as *Venetian, English*, and *Berlin reds,* are chiefly composed of ferric oxide. Peroxide of iron possesses tonic and somewhat styptic properties, and is used principally in *strumous* and *neuralgic affections*, in combination with extract of conium. The dose is from 2 to 8 grains, 3 or 4 times a day. It may also be used in the preparation of iron plaster.

Styptic Powder.—The *red* or *styptic powder* is prepared by merely submitting sulphate of iron 2 parts, and alum 1 part, to a red heat, and continuing it until a reddish substance is formed; it undoubtedly contains a portion of acid. It is powerfully astringent and styptic, and is used as an application to *bleeding piles* and *external hemorrhages;* it is usually applied in the form of ointment, but may also be given internally for the same purposes.

Ochres.—These are natural mixtures of calcareous or argillaceous earths and oxides of iron and manganese in variable proportions. They appear in commerce in powder or masses (stone ochres). Their colors largely depend upon the quantity of iron present, and upon its degree of oxidation. Occasionally heat is employed to modify the color. The chief ochres are *yellow ochre, red ochre, brown ochre, Spanish brown, Indian red, French ochre* (yellow), *Roman ochre,* (brown-yellow becoming purple-red when heated), and *Oxford ochre* (brownish-yellow less intense than that of Roman ochre).

Indian Red, *Red ochre.*—From isle of Orrnus, in the Persian Gulf. A purple-red pigment whose color is due to the presence of ferric oxide.

Umber, *Terra umbra.*—Klaproth states that 100 parts of this mineral contain the following substances: Alumina (5), silica (13), manganese (20), ferric oxide (48), water (14). The commercial variety, which is called *raw umber*, comes from the island of Cyprus. Umber is light, fine, and dense in texture, dry, and has a rich, light-brown color. When rubbed with the finger nail it assumes a gloss. Burning changes it to the beautiful and distinctive deep-brown known as the color of *burnt umber.* Both this and *raw umber* are much used in painting.

Ferrum Oxidatum Saccharatum, *Ferric saccharate, Saccharated oxide of iron, Saccharated iron.*—Add gradually, with stirring, a solution of sodium carbonate (26 parts), in water (150 parts), to a mixture of solution of ferric chloride, sp. gr. 1.281 (30 parts), and water (150 parts), until complete precipitation has taken place. Wash the salt by repeated decantations with water, until it no longer gives evidence of chlorides, then drain the precipitate on muslin and squeeze it. Now add to the residue powdered sugar (50 parts), and solution of soda, sp. gr. 1.70 (5 parts), and heat the mixture on a steam-bath to complete solution. Dry by evaporation, and powder the salt, and finally add enough powdered sugar to produce 100 parts, by weight, of ferric saccharate. This salt is official in the *German Pharmacopœia.* It forms a red-brown powder; its taste is mildly ferruginous and sweet. Distilled water completely dissolves it, forming a feebly alkaline, red-brown solution. This solution, unless hydrochloric acid be present, is unaffected by potassium ferrocyanide. Hydrochloric acid, however, causes at first a dirty-green coloration, followed by the gradual formation of a deep-blue precipitate. This compound contains about 3 per cent of iron. It enters into a syrup, also official in the *German Pharmacopœia*, the Syrupus Ferri Oxydati, or *Syrup of soluble ferric oxide*, made by mixing equal parts of distilled water, saccharated iron, and simple syrup. This contains, therefore, 1 per cent of metallic iron, and is of a deep red-brown color. Upon the statement of Köhler of Halle, saccharated oxide of iron seems to be of importance in *poisoning by arsenous acid* (arsenic). Köhler prefers it to other antidotes for this poison.

Ferri Subcarbonas, *Subcarbonate of iron, Crocus martis aperiens, Crocus martis aperitivus, Precipitated carbonate of iron, Red oxide of iron, Sesquioxide of iron, Aperitive saffron of Mars.*—It is prepared by double decomposition: Take of sulphate of iron, 4 pounds; carbonate of sodium, 4 pounds and 2 ounces; boiling water, 6 gallons (Imp.). Dissolve the sulphate and carbonate separately, each in 3 gallons of water. Mix the solutions together while yet hot, and then let the precipitate subside. Pour off the supernatant liquor, wash the precipitate repeatedly with water, and dry it (*Lond.*).

This process is about the same as that of the *U. S. P.* of 1870, which directed sulphate of iron, 8 ounces; sodium carbonate, 9 ounces, and water, 8 pints. The salt is to be prepared without heat being employed. By exposure to the air during the washing and drying, the ferrous carbonate is converted into ferric oxide by the action of the oxygen of the atmosphere, while carbon dioxide is disengaged. It usually contains a small portion of undecomposed ferrous carbonate, and is known by the name subcarbonate of iron, which distinguishes it from the ferric oxide of the preceding article. It should not be exposed to a red heat for the purpose of improving its red color, as it becomes changed in its character as well as in its medicinal efficacy. When dried at the temperature of the air it is mainly the oxyhydrate ($Fe_2O_3.Fe_2[OH]_6$). Commercial subcarbonate of iron is a brownish-red powder, of a somewhat astringent taste, odorless, not magnetic, and not dissolved by water. It is soluble in hydrochloric acid, with feeble effervescence, which solution affords a deep-blue precipitate with the ferrocyanide of potassium, a purplish-black precipitate with tincture of nut-galls, a brownish-red precipitate with the alkalies, and a red color with sulphocyanic or meconic acid. It also gives a blue precipitate with ferricyanide of potassium, thus showing the difference between this compound and ferric hydroxide. If it contain copper, that metal will be deposited on a bright rod of iron dipped into the above solution. After the ferric oxide has been thrown down by ammonia from the hydrochloric solution, the supernatant liquor should give no indication of any other metal in solution when chloride of barium, ferrocyanide of potassium, or hydrogen sulphide are added. In large doses it is apt to occasion nausea, with a heavy sensation in the epigastric region, and other dyspeptic symptoms; it also renders the stools black. It is an excellent chalybeate tonic and alterative, and has been successfully used in *chorea*, *neuralgia*. *chlorosis*, and *anemia*. Sometimes used in *intermittent fever*, when connected with an anemic condition, or where the nutritive functions are deranged. In *chronic diarrhœa* and *dysentery*, *enlargement of the liver and spleen*, *epilepsy*, *dropsy*, *cancer*, *scrofula*, and *diseases of the urinary organs* connected with debility, it has been successfully used. The dose is from 5 grains to 2 drachms, 3 times a day; there is, however, no necessity for large doses of any of the chalybeates, as the system can take up but a small portion daily of any of the iron compounds.

FERRI OXIDUM HYDRATUM CUM MAGNESIA (U. S. P.)—FERRIC HYDRATE WITH MAGNESIA.

SYNONYMS: *Arsenic antidote*, *Antidotum arsenici.*

Preparation.—"Solution of ferric sulphate, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; magnesia, ten grammes (10 Gm.) [154 grs.]; water, a sufficient quantity. Mix the solution of ferric sulphate with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of water, and keep the liquid in a large, well-stoppered bottle. Rub the magnesia with cold water to a smooth and thin mixture, transfer this to a bottle capable of holding about one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and fill it with water to about three-fourths of its capacity. When the preparation is wanted for use, shake the magnesia mixture to a homogeneous, thin magma, gradually add to it the iron solution, and shake them together until a uniform, smooth mixture results.

Note.—"The diluted solution of ferric sulphate, and the mixture of magnesia with water, should always be kept on hand, ready for immediate use"—(*U. S. P.*).

This preparation, intended as an antidote to arsenic, is a mixture of ferric hydroxide, magnesium hydroxide, and magnesium sulphate. It should be freshly prepared so that the ferric hydroxide will be in its most efficient condition, and not impaired, as is certain to be the case if the preparation be kept for a length of time. It is not necessary to separate the liquid from this preparation, as none of the ingredients are in any way caustic or objectionable, the magnesium sulphate present being desirable as a cathartic to carry off by the bowels such portions of the insoluble arsenical compound as may not be ejected in the act of emesis, or removed by the stomach-pump. As an excess of magnesia is used in preparing it, acidity is avoided.

Action, Medical Uses, and Dosage.—Antidote to *arsenical poisoning.* It should be administered like the ferric hydroxide. The magnesia itself is somewhat antidotal to arsenous acid, beside acting as a cathartic.

FERRI PHOSPHAS SOLUBILIS (U. S. P.)—SOLUBLE FERRIC PHOSPHATE.

SYNONYMS: *Ferri phosphas of U. S. P.* (1880), *Soluble phosphate of iron*, *Sodio-ferric citro-phosphate*, *Ferri et sodii citro-phosphas*, *Ferrum phosphoricum cum natrio citrico.*

Preparation.—"Ferric citrate, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; sodium phosphate, uneffloresced, fifty-five grammes (55 Gm.) [1 oz. av., 411 grs.]; distilled water, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Dissolve the ferric citrate in the distilled water by heating on a water-bath. To this solution add the sodium phosphate, and stir constantly until it is dissolved. Evaporate the solution on a water-bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of thick syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in dark amber-colored, well-stoppered bottles"—(*U. S. P.*).

This modern salt was at first called *Ferri Phosphas*, but the Pharmacopœial Committee of 1890 very properly designated it as *Soluble ferric phosphate*, thus preventing it from being confounded with *True ferric phosphate*. It is a different preparation from that of former pharmacopeias and of the *British Pharmacopœia*, which is an amorphous, slate-blue powder, and contains at least 47 per cent of ferrous phosphate ($Fe_3[PO_4]_2.8H_2O$), together with ferric phosphate and some oxide. The present *U. S. P.* salt, on the other hand, is in the form of bright-green scales, and is probably a *sodio-ferric citro-phosphate*, the formula for which is not given. The British preparation is insoluble in water, while that of the *U. S. P.* is soluble. To insure the scales from turning white by age, a perfectly uneffloresced sodium phosphate must be employed, as directed in the above formula.

Description and Tests.—"Thin, bright-green, transparent scales, without odor, and having an acidulous, slightly saline taste. The salt is permanent in dry air when excluded from light, but becomes dark and discolored on exposure to light. Freely and completely soluble in water, but insoluble in alcohol. The aqueous solution of the salt has a slightly acid reaction. With potassium ferrocyanide T.S. the solution gives a blue color, but does not yield a blue precipitate, unless it has been acidulated with hydrochloric acid. If 1 Gm. of the salt be boiled with 10 Cc. of potassium or sodium hydrate T.S., a reddish-brown precipitate will be produced, and if the colorless filtrate from this precipitate be strongly acidulated with hydrochloric acid, then magnesia mixture added, and subsequently a slight excess of ammonia water, an abundant, white crystalline precipitate will be produced. If a portion of the filtrate from this precipitate be acidulated with acetic acid, and heated to boiling, no further precipitate should be produced (absence of pyrophosphate). If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 Cc.) in 15 Cc. of water and 2 Cc. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for ½ hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 12 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 1 per cent of metallic iron)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This salt has uses similiar to those enumerated below under *Ferri Phosphas*. Dose, 5 to 10 grains. Ferric phosphate is one of the special sedatives of the Schuessler system of therapy, and is used in the beginning of *febrile* and *inflammatory troubles* before exudations occur. It is employed by some practitioners where a persistent high temperature exists in threatened structural disease, and in those lingering febrile states which tend to chronicity, or where there is great adynamia with fever (Webster). *Salpingitis*, *pelvic cellulitis*, and *scleroses of the liver*, all in the early stage, are treated with this remedy and potassium chloride in alternation, to check the inflammatory process. R Ferric phosphate, 3 x trit., grains v, aqua fl℥iv. Mix. Dose, teaspoonful every hour.

Related Compounds.—FERRI PHOSPHAS, *Phosphate of iron*, *Ferroso-ferric phosphate*, *Phosphas-ferroso-ferricus*, *Ferrum phosphoricum*. The *British Pharmacopœia* directs that ferrous sulphate (3 ounces, Imp., or 60 grammes) and phosphate of sodium (2¾ ounces, Imp., or 55 grammes) be each dissolved in boiling distilled water (30 ounces, or 600 cubic centimeters). Cool the solutions to between 37.8° and 54.4° C. (100° and 130° F.). Add the solution of sodium salt to the solution of iron salt, at the same time adding a little of solution of sodium bicarbonate (¾ ounce, Imp., or 15 grammes, in a little distilled water). Thoroughly mix the solutions, filter through calico, wash the precipitate with hot distilled water until the filtrate gives no precipitate with barium chloride, and dry at a temperature not above 48.9° C. (120° F.).

When solutions of ordinary phosphate of sodium and sulphate of iron are brought together, a white precipitate is formed, which, so long as the sulphate of iron is in excess, is a hydrated tribasic phosphate of iron of the composition $Fe_3(PO_4)_2+8H_2O$. This precipitate acquires, almost directly after its formation, a bluish-gray shade which, by washing, becomes somewhat stronger. When exposed to the air the precipitate becomes, as it dries, blue throughout.

Ferrous phosphate is a beautiful lavender-blue, odorless and tasteless powder. When exposed to a moderate warmth it instantly loses its blue color, becoming a greenish-gray; more strongly heated, the water is given off, the ferrous converted into a ferric salt, and the residue becomes grayish-brown. It is not dissolved by water, but dissolves in acids. Hydrochloric acid forms a greenish-yellow solution with it; in this solution ferricyanide of potassium readily detects the ferrous oxide by its blue precipitate, and sulphocyanide of potassium the ferric oxide, by its blood-red color. If the hydrochloric solution is thrown down by excess of ammonia, the supernatant liquid must be colorless; a blue color would denote copper (Witt.).

Phosphate of iron is a valuable chalybeate tonic. It has been recommended as a remedy in *cancer*, to be used internally, and also applied to the diseased part; likewise to restore and invigorate the virile powers. Marked advantage has been derived from its use in *febrile diseases*. The dose is from 1 to 10 grains, 3 times a day. Dr. Routh has met with much success in some cases of *anemia* and *debility*, brought on by venereal or other excesses, over-study, and depressing diseases, by the use of another preparation of phosphate of iron, a *superphosphate*, which he has found better adapted for a speedy cure than other preparations of iron. It has likewise been of much benefit in cases of *virile weakness from onanism*, or other causes. It is prepared by adding as much phosphate of iron as the metaphosphoric acid (HPO_3), in a boiling state, would take up, and allowing it to cool. The proportions will be found nearly 2 of acid to 1 of the phosphate. The solution obtained is of a semi-transparent, greenish or slaty hue, which hardens on exposure to the air for a day; but mixed with liquorice powder or flour, it can be at once made up into pills. The compound is soluble in any proportion of water, and free from any nauseous, inky taste. Whether it is a superphosphate of iron, or the mere solution of the phosphate in the acid, remains yet to be determined. It does not gripe nor constipate, and has proved beneficial in cases of debility, where there is a prevalence of nervous symptoms, or a large quantity of phosphates voided by urine. Dose, 1 or 2 grains, 3 times a day—in some instances combined with an equal proportion of phosphate of quinine.

Ferri Phosphas Albus, *Ferric phosphate, White phosphate of iron.*—Formula: $Fe_2(PO_4)_2\ 4H_2O$. Molecular Weight: 373.8. If solution of ferric phosphate (4 ounces) be mixed with solution of sodium acetate (1 ounce), and sodium phosphate in solution be added, ferric phosphate precipitates as a white salt. When washed and dried at 100° C. (212° F.) a white, or yellow-white and tasteless powder results. Mineral acids (diluted), tartaric, and citric acids, as well as alkali citrates readily dissolve it, the latter giving green solutions. Alkalies decompose it.

Milk of Iron (*Lac ferri*).—This is a mixture of the freshly prepared ferric phosphate in water, the mixture containing from 1 to 1.2 per cent of the salt.

The following formula appeared in the first edition of the *National Formulary:*

Ferri Phosphas Effervescens (N. F.), *Effervescent phosphate of iron.*—"Phosphate of iron (*U. S. P.*, 1880), 40 parts; bicarbonate of sodium, 600 parts; tartaric acid, 540 parts; sugar, in very fine powder, 620 parts. Triturate the ingredients, previously well dried, to a fine, uniform powder. If the compound is required in form of a granular powder, mix it with alcohol to a soft paste, and rub this through a No. 20 tinned-iron sieve or enamelled colander. Then dry it, and reduce it to a coarse, granular powder. Ninety (90) grains (or about a heaped teaspoonful) of the above compound represents 2 grains of phosphate of iron"—(*Nat. Form.*, first edition).

FERRI PYROPHOSPHAS SOLUBILIS (U. S. P.)—SOLUBLE FERRIC PYROPHOSPHATE.

Synonyms: *Ferri pyrophosphas of U. S. P.* (1880), *Pyrophosphate of iron with sodium citrate, Sodio-ferric citro-pyrophosphate, Ferrum pyrophosphoricum cum sodio citrico, Ferri et sodii citro-pyrophosphas, Pyrophosphas ferricus cum citrate sodico.*

Preparation.—"Ferric citrate, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; sodium pyrophosphate, uneffloresced, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; distilled water, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Dissolve the ferric citrate in the distilled water, by heating on a water-bath. To this solution add the sodium pyrophosphate, and stir constantly, until it is dissolved. Evaporate the solution, on a water-bath, at a temperature not exceeding 60° C. (140° F.), to the consistence of thick syrup, and spread it on plates of glass, so that, when dry, the salt may be obtained in scales. Keep the product in dark amber-colored, well-stoppered bottles"—(*U. S. P.*).

Ammonium citrate was formerly used in the preparation of this compound. (For Dr. E. R. Squibb's process, employing the ammonium salt, see King's *American Dispensatory*, 15th ed., p. 1028). Owing to the fact that true ferric pyrophosphate ($Fe_4[P_2O_7]_3$) is not soluble in water, the *U. S. P.* has wisely changed the name of this compound from Pyrophosphate of Iron to *Soluble* Ferric Pyrophosphate. Soluble pyrophosphate of iron is thought to be composed of sodio-ferric citrate, sodio-ferric pyrophosphate, and ferric citrate in an uncombined condition.

Description and Tests.—The *U. S. P.* describes this salt as follows: "Thin, apple-green, transparent scales, without odor, and having an acidulous, slightly saline taste. The salt is permanent in dry air, when excluded from light, but becomes dark and discolored on exposure to light. Freely and completely soluble in water, but insoluble in alcohol. The aqueous solution of the salt has a slightly acid reaction. With potassium ferrocyanide T.S. it gives a blue color, but does not yield a blue precipitate, unless it has been acidulated with hydrochloric acid. If 1 Gm. of the salt be boiled with 10 Cc. of potassium or sodium hydrate T.S., a reddish-brown precipitate will be produced, and if the colorless filtrate from this precipitate be strongly acidulated with hydrochloric acid, then magnesia mixture added, and subsequently a slight excess of ammonia water, no precipitate should be produced (distinction from and absence of ferric phosphate). If a portion of the filtrate be acidulated with acetic acid, and heated to boiling an abundant, white, flocculent precipitate (pyrophosphate) will be produced. If 0.56 (0.558) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 Cc.) in 10 Cc. of water, then 10 Cc. of hydrochloric acid, and subsequently 40 Cc. of water added, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for ½ hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 10 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 1 per cent of metallic iron)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Pyrophosphate of iron is an excellent chalybeate tonic, and may be given in all cases where iron is indicated; from its ready solubility it may be added advantageously to many syrups and solutions. Its dose is from 2 to 5 grains, repeated 2 or 3 times a day. It appears to thoroughly influence the system, but without any unpleasant or harsh action.

Preparations.—Syrup of Pyrophosphate of Iron. This preparation may be made by dissolving 160 grains of soluble pyrophosphate of iron in 4 fluid ounces of warm water, and mixing this solution with 12 fluid ounces of simple syrup. Each tablespoonful will contain 5 grains of the salt. Owing to the tendency to mould by age, it must be prepared fresh when wanted.

Liquor Ferri Pyrophosphatis, *Solution of ferric pyrophosphate.*—Ferric pyrophosphate, 120 grains; water, 5 fluid drachms. Make an aqueous solution by means of heat, filter while still hot; mix glycerin (2 fluid drachms) with the filtrate, and bring the product to the measure of 1 fluid ounce by the addition of water. This is according to Rother's method, and forms a permanent ferric pyrophosphate solution (*Drug. Circular*, 1886, p. 99).

Related Compound.—Ferri et Sodii Pyrophosphas, *Natrium pyrophosphoricum ferratum*, *Sodio-ferric pyrophosphate.* This compound is prepared by dissolving sodium pyrophosphate (200 parts) in water (400 parts) and adding an aqueous solution of ferric chloride just short of the formation of a permanent precipitate. Mix the greenish solution thus formed with alcohol (1000 parts). The result is a white precipitate which forms a non-crystalline powder on drying, dissolving with difficulty in water. Ferric chloride added to the solution causes a precipitate of ferric pyrophosphate.

FERRI SULPHAS (U. S. P.)—FERROUS SULPHATE.

Formula: $FeSO_4+7H_2O$. Molecular Weight: 277.42.

Synonyms: *Sulphate of iron*, *Sulfas ferrosus*, *Ferrum vitriolatum purum*, *Vitriolum martis purum.* When impure, *Green vitriol* and *Copperas.*

Preparation.—In a glass flask, or, on the large scale, in a leaden vessel, are mixed 6 parts of concentrated sulphuric acid with 24 parts of water, and 4 parts of pure iron (turnings or filings); the whole, frequently stirred with a porcelain or wooden spatula, is allowed to digest for 1 day; the vessel is now heated as long as any gas is evolved, then filtered, the hot filtrate mixed with ¼ part of concentrated sulphuric acid, and allowed to stand 2 days in a cool spot. The crystals which have formed, are freed from the mother liquor, and spread out on paper, if possible, in the sun to dry; then kept in a well-closed bottle or stone jar. The solution yields, on concentration, a considerable portion of salt, and from the above proportion of ingredients, 17 parts of ferrous sulphate are obtained (Wittstein).

"Concentrated sulphuric acid has no action on iron in the cold, but mixed with a certain portion of water, a lively effervescence ensues, with evolution of hydrogen gas. The free carbon of the iron separates in black flakes, while the combined carbon, at the moment of liberation, combines with hydrogen, and is given off as methane or marsh gas (CH_4), imparting to the hydrogen its unpleasant odor. If traces of phosphorus and sulphur are present, the evolved gases are not free from ill-smelling phosphide and sulphide of hydrogen."

"Ferrous sulphate should be kept in well-stoppered bottles"—(*U. S. P.*).

Description.—The official salt occurs in "large, pale bluish-green monoclinic prisms, without odor, and having a saline, styptic taste; efflorescent in dry air. On exposure to moist air, the crystals rapidly absorb oxygen, and become coated with brownish-yellow, basic ferric sulphate. Soluble in 1.8 parts of water at 15° C. (59° F.), and in 0.3 part of boiling water; insoluble in alcohol. When slowly heated to 115° C. (239° F.), the crystals fall to powder, and lose 38.84 per cent of their weight (6 molecules of water of crystallization)"—(*U. S. P.*).

A solution of sulphate of iron when exposed to the air becomes of a yellow color, and contains ferroso-ferric salt, while a yellow basic ferric salt separates. When heated, sulphate of iron fuses in its water of crystallization, leaving upon evaporation a white powder, which heated more strongly in the air absorbs oxygen and becomes red; heated gradually to redness, it evolves sulphuric acid, water, and sulphurous acid, while a dark crimson-red powder of pure ferric oxide remains.

Tests.—Any contamination of sulphate of iron by ferric sulphate may be known by the gray or greenish-yellow color of the crystals, and chemically shown by sulphocyanide of potassium, which renders its solution blood-red.

The *U. S. P.* directs the following tests: "The aqueous solution of the salt has an acid reaction, and, even when highly diluted, gives with potassium ferricyanide T.S. a blue color, or precipitate, and with barium chloride T.S., a white precipitate insoluble in hydrochloric acid. If 1 Gm. of the salt be dissolved in about 25 Cc. of water, the solution heated to boiling, oxidized with nitric acid, and then mixed with a slight excess of ammonia water, the filtrate from the reddish-brown precipitate should be colorless, and should not be affected by hydrogen sulphide T.S. (absence of copper, zinc, etc.). If another portion of the filtrate be evaporated to dryness, and then ignited, it should not leave more than a trace of residue (limit of salts of the fixed alkalies). If 1.39 (1.3871) Gm. of the salt be dissolved in about 25 Cc. of water, and the solution acidulated with sulphuric acid, not less than 50 Cc. of decinormal potassium permanganate V.S. should be required to impart to the liquid a permanent pink color (each cubic centimeter of the volumetric solution indicating 2 per cent of crystallized ferrous sulphate)"—(*U. S. P.*).

The impure sulphate of iron (copperas) met with in commerce should not be used in medicine.

Action, Medical Uses, and Dosage.—In small doses, sulphate of iron causes more or less constipation, is absorbed, and acts as a tonic, astringent, and emmenagogue; it blackens the stools. In large doses, it causes pain, heat, uneasiness at the pit of the stomach, and retchings and emesis. In excessive doses, it is an irritant poison, acting chemically on the albumen and other organic constituents of the tissues. The stomach is more or less injured by a long-continued use of it. It has been used as a tonic in *scrofula*, *dyspepsia*, *chlorosis*, *amenorrhœa*, and in *debility* following protracted diseases. In *phthisis pulmonalis* the following preparation has been found very serviceable; it relieves cough, assists expectoration, improves the appetite and digestive functions, and invigorates the whole system: Take of commercial sulphate of iron 6 drachms; whiskey or good Holland gin, ½ pint; mix together. The dose is ½ fluid drachm every 2 hours. As an astringent, sulphate of iron is given in *humid asthma*, *passive hemorrhages*, *chronic mucous catarrh*, *leucorrhœa*, *gleet*, *diabetes*, *old dysenteric affections*, etc. The dose is from ½ to 6 grains in pill form. Prof. A. J. Howe states that "a strong solution of sulphate of iron has effected cures of *diabetes*, and may sometimes be successfully employed in *dropsies* arising from various causes. A solution holding 10 grains of the sulphate to 1 fluid ounce of water, may be given in doses of from 2 to 4 fluid drachms, repeated 3 or 4 times a day. In some instances where diuretics and hydragogue cathartics have been employed without beneficial results, the sulphate of iron has produced the happiest effects." From 1 to 10 grains of the sulphate of iron dissolved in 1 fluid ounce of boiling water has been found useful as a collyrium in *chronic ophthalmia*, a wash (or, with lard, as an ointment) in *erysipelas* and some *eczematous skin diseases*, and as an injection in *gleet* and *chronic dysentery*, *prolapsus of the rectum*, etc. *Cancerous parts*, particularly of the uterus, may be washed with a solution of 1 drachm of the salt to 1 pint of water. An injection of 2 grains to 1 pint of water relieves *bleeding piles*. Applied locally the solution does good service in *chancroid*. Sulphate of iron has been used as a disinfectant, particularly in correcting foul odors from cesspools, drains, vaults, etc. It may be used freely, either in substance or in solution, the products being sulphate of ammonium and hydrated sulphide of iron. Sulphate of iron becomes changed when in contact with the atmosphere, and which alteration may be prevented by sprinkling the crystals of this salt with alcohol, or with sweetened water, and keeping them in well-closed vessels. Mr. Welborn has succeeded in preserving them by a still more simple method, viz.: by placing a small fragment of camphor in the upper part of the vessel containing the ferrous salt. Animal tissues become mummified when taken from a solution of neutral sulphate of iron (3 per cent) in which they have been immersed for some time. A weak solution of ferrous sulphate is one of the most effective applications to *rhus poisoning*. Dose, ½ to 6 grains, or 3 x trit., 1 to 5 grains.

Specific Indications and Uses.—General relaxation and languor of the system: uterine inactivity; amenorrhœa. Locally, to rhus poisoning.

FERRI SULPHAS EXSICCATUS (U. S. P.)—DRIED FERROUS SULPHATE.

FORMULA: Approximately, $2FeSO_4+3H_2O$. MOLECULAR WEIGHT: 357.28.

SYNONYMS: *Ferri sulphas exsiccata, Dried sulphate of iron, Dried ferrous sulphate.*

Preparation.—"Ferrous sulphate, in coarse powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Allow the salt to effloresce at a temperature of about 40° C. (104° F.), and then heat it in a porcelain dish, on a water-bath, constantly stirring, until the product weighs from sixty-four to sixty-five grammes (64 to 65 Gm.) [2 ozs. av., 113 grs., to 2 ozs. av., 128 grs.]. Lastly, reduce the residue to a fine powder, and transfer it at once to perfectly dry, well-stoppered bottles"—(*U. S. P.*).

Description.—"A grayish-white powder, slowly but completely soluble in water, and conforming approximately to the reactions and tests given under *Ferri Sulphas*"—(*U. S. P.*). The granulated sulphate is best adapted for the preparation of the anhydrous salt. With extra care the salt may be heated to 280° C. (536° F.), without loss of the acid, at which point the last molecule of water is driven off.

Action, Medical Uses, and Dosage.—Same as sulphate of iron; to be used in pill form. Externally, in solution, as an astringent lotion for *indolent ulcers*, and as an injection in *leucorrhœa* and *gonorrhœa* of females.

FERRI SULPHAS GRANULATUS (U. S. P.)—GRANULATED FERROUS SULPHATE.

FORMULA. $FeSO_4+7H_2O$. MOLECULAR WEIGHT: 277.42.

SYNONYMS: *Ferri sulphas præcipitatus* (*Pharm.*, 1880), *Ferri sulphas granulata, Precipitated ferrous sulphate, Granulated sulphate of iron, Precipitated sulphate of iron.*

Preparation.—"Ferrous sulphate, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; distilled water, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; diluted sulphuric acid, five cubic centimeters (5 Cc.) [81 ♏]; alcohol, twenty-five cubic centimeters (25 Cc.) [406 ♏]. Dissolve the ferrous sulphate in the distilled water previously heated to boiling, add the diluted sulphuric acid, and filter the solution while hot. Evaporate the solution immediately in a tared porcelain capsule, on a sand-bath, until it weighs one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.], and then cool it quickly under constant stirring. Transfer the product to a glass funnel stopped with a plug of absorbent cotton, and when it has thoroughly drained, pour upon it the alcohol. When this also has drained, spread the crystalline powder on bibulous paper, dry it quickly in the sunlight, or in a dry room, at the ordinary temperature, and transfer it at once to perfectly dry, well-stoppered bottles"—(*U. S. P.*).

Description.—"Granulated ferrous sulphate is a very pale, bluish-green, crystalline powder, which should conform in every respect to the reactions and tests given under *Ferri Sulphas*"—(*U. S. P.*). Granulated sulphate of iron does not oxidize as readily as does the ordinary sulphate, and is preferred to that salt in making dried sulphate of iron, and also the syrup of phosphate of iron.

Action, Medical Uses, and Dosage.—Uses same as *Ferrous Sulphate*, which see.

FERRI SULPHIDUM.—FERROUS SULPHIDE.

FORMULA: FeS. MOLECULAR WEIGHT: 87.86.

SYNONYMS: *Sulphide of iron, Sulphuretum ferrosum, Sulphuret of iron, Ferri sulphuretum, Protosulphide of iron.*

Preparation.—Sulphide of iron may be made by heating an iron rod to a full white heat in a forge, applying a stick of sulphur to the end of the rod, and allowing the fused globules of sulphide which form to fall into a deep vessel filled with water. These should be free of sulphur and kept in a close vessel. In this process, to be successful the iron must be raised to a full white heat; at a lower temperature the sulphur is merely fused on its surface; but if the heat be high enough, the two bodies unite with the emission of brilliant sparks, when the ferrous sulphide is instantly formed, and falls in a fused and incandescent state, and, on being received in the water, brownish-yellow globules are obtained, having a somewhat crystalline texture (Wittstein). An inferior preparation may be obtained by mixing thoroughly together sublimed sulphur 1 part, and iron filings 3 parts. Heat the mixture in a covered crucible till it becomes red hot, then remove the crucible from the fire, still keeping it covered, and allow the action to go on without any further heat (*Ed.*).

Several sulphides of iron are known, but only one used in pharmacy, viz.: the ferrous sulphide. Iron and sulphur combine at a red heat to form this sulphide. The excess of sulphur vaporizes, and, coming in contact with the air, ignites to form sulphur dioxide (SO_2). Three hundred and fifty parts of iron require 200 parts of sulphur, but an excess of the latter is always necessary, as, before the combination of the two is complete, a portion has been volatilized. When made by the second process, the crucible must not be opened until quite cool, otherwise the mass absorbs oxygen with avidity, becoming partly converted into a sulphate of iron.

Description.—Sulphide of iron varies in appearance according to its mode of preparation; by the first-named process it is yellowish, by the second a dark-gray mass, heavy, full of blisters, of a partly metallic luster, odorless, and tasteless. Kept in a close vessel, it undergoes no change; exposed to the air, especially if moist, it oxidizes and acquires an inky taste. In diluted sulphuric or hydrochloric acid it must, with a powerful evolution of hydrogen sulphide gas, gradually and almost entirely dissolve (a thorough solution must not be expected on account of the carbon in the iron), and the gas must be entirely absorbed by a solution of acetate of lead, else it contains free hydrogen (Wittstein).

Uses.—Sulphide of iron is used in pharmacy and analytical chemistry for procuring HYDROGEN SULPHIDE (*Hydrosulphuric acid* or *Sulphuretted hydrogen gas*).

HYDROGEN SULPHIDE.—Formula: H_2S. Molecular Weight: 33.98. It may be prepared as follows: Diluted sulphuric or hydrochloric acid is added to sulphide of iron in a proper vessel, when the sulphuretted hydrogen is disengaged as a gas, and may be collected over warm water, or solution of salt. The reaction is represented by the following equation: $FeS+H_2SO_4=H_2S+FeSO_4$. The excess of water in the diluted acid promotes the action by keeping in solution the salt which forms. Sulphide of hydrogen is a transparent, colorless gas having the odor of rotten eggs and a specific gravity of 1.178 to 1.19. It reddens litmus, burns in the air with a bluish flame, producing sulphurous acid gas and water, and depositing sulphur on the sides of the vessel in which it is burned. In bottles not quite full or imperfectly corked, its aqueous solution becomes milky, a white powder of sulphur is thrown down, and this can go on until the water contains no scent of the gas. This is owing to the combination of the atmospheric oxygen with the hydrogen, forming water. If the washing of this gas is omitted it may contain sulphuric acid, known by chloride of barium rendering it turbid. Water absorbs two or three times its volume of the gas, and acquires its smell and a nauseous, sweetish taste. Sulphide of hydrogen blackens white lead and solutions of the salts of lead, copper, bismuth, etc. Under a pressure of 17 atmospheres at 10° C. (50° F.), it condenses into a limpid fluid of sp. gr. 0.9, and which freezes at —85° C. (—122° F.), forming a white, crystalline, translucent substance. When respired, even although much diluted with air, it is highly deleterious, and as it is often formed where animal matters or excrements putrefy, as in burying vaults or cloacæ, it not infrequently causes the death of the workmen who suddenly come in contact with it. When air is moderately diluted with it, respiration causes immediate insensibility with depression of all the powers of life; still more diluted, it causes convulsions, and air but slightly contaminated with it, causes nausea, debility, and headache. The smell of the gas ought, in all cases, to be viewed as a warning of danger.

From many metallic solutions hydrogen sulphide gas precipitates the metal in the form of *sulphide*. Upon the difference in the solubilities of these sulphides is based an analytical classification of the metals, an important subject that we can not, however, consider in detail. The gas is usually generated in the well-known Kipp's apparatus, but numerous other and simpler devices have been suggested.

Hydrogen sulphide, as it exists naturally in some mineral waters, is undoubtedly of value in *cutaneous disorders*, particularly those in which calcium sulphide is beneficial. The Bergeon method of rectal injection of hydrogen sulphide for the cure of *phthisis* proved to be injurious instead of beneficial.

FERRI VALERIANAS (U. S. P.)—FERRIC VALERIANATE.

SYNONYMS: *Valerianate of iron, Ferrum valerianicum.*

Preparation.—This compound may be made as follows: Take clean iron filings, put into a Wedgewood mortar, add gradually an equal weight of valerianic acid, and stir constantly. In an hour add distilled water; gently warm the whole in a flask and filter. The surface in contact with the air soon becomes covered with a crystalline layer of the iron valerianate; collect this on a filter, and expose as before, repeating the process as long as crystals are obtained (Ruspini). It is generally made, however, by acting upon solution of ferric chloride or ferric sulphate with solution of sodium valerianate. The following is Wittstein's method: To a solution of 3 parts of crystallized ferric chloride in 100 parts of water, add a cold solution of sodium valerianate, made by saturating 5 parts of oily valerianic acid in 60 parts of water, with sodium carbonate, and then boiling the liquid to expel all the carbon dioxide. The valerianic acid drives off the carbon dioxide from the sodium carbonate, and uniting with the base, forms a neutral salt. Fifteen hundred parts of the terhydrated valerianic acid require 1790 parts of crystallized carbonate of sodium. If this neutral solution is added in sufficient quantity (as long as it causes a precipitate), to a solution of ferric chloride, or any persalt of iron, a dark brick-red precipitate of valerianate of iron is formed, and readily soluble sulphate or chloride of sodium. Forty-five hundred parts of valerianic acid saturated with sodium carbonate require 2704 parts of crystallized ferric chloride, or 3513 parts of dry ferric sulphate. The affinity between the oxide of iron and valerianic acid is so feeble that a gentle heat will remove most of the acid; consequently, the precipitation should take place only when cold. The precipitated valerianate of iron is to be washed with a little cold water, and dried at a temperature not exceeding 20° C. (68° F.). If too much water be used, or if the washing be continued, the acid will be removed.

Its composition, which is variable, depends on the processes by which it is made.

Description and Tests.—This salt is officially described as "a dark brick-red, amorphous powder of somewhat varying chemical composition, having the odor of valerianic acid, and a mildly styptic taste; permanent in dry air. Insoluble in cold water, but readily soluble in alcohol. Boiling water decomposes it, setting free the valerianic acid, and leaving ferric hydrate. When slowly heated, the salt parts with its acid, without fusing, but, when rapidly heated, it fuses and gives off inflammable vapors having the odor of butyric acid, and, on complete ignition, leaves a residue of ferric oxide. The stronger acids decompose the salt with the liberation of valerianic acid. If 0.56 (0.5588) Gm. of the salt be dissolved in a glass-stoppered bottle (having a capacity of about 100 Cc.) in 2 Cc. of hydrochloric acid and 15 Cc. of water, and after the addition of 1 Gm. of potassium iodide the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled and mixed with a few drops of starch T.S., it should require not less than 15 nor more than 20 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 1 per cent of metallic iron)"—(*U. S. P.*).

"Ferric valerianate should be kept in small, well-stoppered bottles, in a cool and dark place"—(*U. S. P.*). Valerianate of iron is not extensively employed by Eclectic practitioners.

Action, Medical Uses, and Dosage.—Valerianate of iron is a nervo-tonic. and will be found serviceable in *nervous disorders*, *hysteria*, *chorea*, *neuralgia*, *chlorosis*, and *anemic conditions* with excitability or irritability of the nervous system. The dose is 1 or 2 grains in pill form, repeated 3 or 4 times a day.

FERRUM (U. S. P.)—IRON.

SYMBOL: Fe. ATOMIC WEIGHT: 55.88.

"Metallic iron in the form of fine, bright, and non-elastic wire"—(*U. S. P.*).

The *British Pharmacopœia* directs annealed iron wire (diameter 0.005 inch) or wire nails, both to be free from oxide. Iron filings (*Ferri Ramenta*) were directed by the *U. S. P.*, of 1850.

Source, History, and Preparation.—No metal is of more utility to mankind, or more abundantly dispersed throughout the globe than iron. Independently of its existence in the form of ores, it is found to a greater or less extent as a constituent of earths, minerals, and organized substances. It is found in meteoric stones, and forms an essential constituent of the blood in man and many animals, and is one of those metals which, under certain circumstances, may be employed medicinally with safety and advantage to the human constitution.

Iron occurs in its native state, and in combination with other substances forming iron ores. Its most common ores are the sulphide of iron (pyrites), the oxides, such as magnetic iron ore (Fe_3O_4), red and brown hematite, micaceous, and clay iron ores; and the carbonate, phosphate, sulpharsenide, etc., of iron. A superior iron is obtained from those ores known as magnetic, red hematite, or micaceous; these are found in abundance in Sweden. Spain, France, and Germany likewise furnish the carbonate, clay iron ore, brown hematite, etc. In this country iron is procured in large quantity, principally from the magnetic, micaceous, and clay iron ores, and some of the ores, especially those of the Atlantic states, are at least equal to the best ore from Sweden.

As the character of the ores differs, the modes of procuring the iron from them will vary according to the kind of ore. Ores containing sulphur can not be used in the metallurgy of iron, only the oxides, carbonates (spathose ores), and clay iron stones being employed. The argillaceous ores and the brown hematites (hydrated ferric oxides) undergo a preliminary process of calcination by mixing them with coal and burning the mixture either in open heaps, or in properly constructed roasting furnaces. The roasted iron ore thus prepared is mixed with flux and fuel, and exposed to a strong heat in a blast furnace. The flux is generally limestone, which separates the alumina and silica; the fuel is charcoal, coke, or anthracite. The impurities which fuse with the flux are termed the *slag*, which floats above the melted iron, and flows in a constant but slow stream over the dam, on the opposite side from that where the metal is to flow. As soon as the process is perfected, the orifice through which the slag flowed is closed, the blast stopped, and the melted iron is run into molds, forming what is known as "*pig iron*," or "*cast iron*." Two varieties of cast iron exist, differing mainly in the form of the carbon present. In *white cast iron* the carbon exists as carbide of iron in combination; in *gray cast iron* most of the carbon exists free as graphite. The presence of manganese in the ore induces the formation of *white cast iron* (or *specular pig iron*), while silica has a tendency to produce *gray cast iron*.

Cast iron is used to make *malleable iron* and *steel*, both containing considerably less carbon. The proportion of carbon determines their properties. To effect the expulsion of the excess of carbon, the "pigs" undergo certain processes of *refining* and *puddling*, in properly constructed furnaces, in which the carbon is gradually burnt out by a free access of air and constant agitation; phosphorus and sulphur also disappear. Finally the iron is removed from the furnace, and either hammered or rolled into long flat or round pieces, forming the ordinary soft or malleable iron. Cast iron contains from 3 to 6 per cent of carbon, malleable iron only from 0.15 to 0.5 per cent, while steel stands intermediate between the two. Diminution of carbon raises the fusing point of iron. Steel can be *hardened* by dipping it red hot into cold water, subsequent annealing, often called *tempering*, being required to deprive it of its brittleness. It may be obtained by different processes, and is now manufactured in great quantities from pig iron by the *Bessemer process*, which consists in burning out the excess of carbon by means of a current of air forced through the molten pig iron contained in a specially constructed pear-shaped vessel, called the *converter*. The heat of the combustion of the carbon is sufficient to maintain the metal in a molten condition. Sheet iron with a coating of tin is known as *tin plate;* coated with zinc it is known as *galvanized iron.*

Description and Properties.—Iron has a grayish color, when pure almost silver white. Its fracture is granular, or irregularly foliaceous, with a metallic luster; when polished it has great brilliancy, which is rapidly lost under exposure to moisture and air combined. Its taste is peculiar and somewhat astringent, and it emits a peculiar smell when rubbed. It has great tenacity and ductility, and considerable malleability, but not so much as gold, silver, copper, etc. Its specific gravity is 7.788, which increases by rolling or drawing. When absolutely pure, it fuses only at a very intense heat, 1800° C. (about 3300° F.), while white pig iron fuses at about 1100° C. (2012° F.). It is attracted by the magnet. Iron wire, having a little cotton tied to its extremity, plunged into oxygen gas or into liquid air while the cotton is in flames, burns brilliantly. Damp atmosphere soon tarnishes its surface, and gradually changes it into a brown or red powder, well known under the name of rust, which is hydrated ferric oxide. Iron combines with oxygen and forms two oxides, *ferrous oxide*, *protoxide*, or *monoxide of iron* (FeO), and the *ferric oxide*, *peroxide*, or *sesquioxide of iron* (Fe_2O_3), and these united form the *black oxide* ($FeO+Fe_2O_3=Fe_3O_4$). A *ferric acid*, or teroxide of iron (FeO_3), has likewise been described. It is not known free, and is very easily decomposed. Iron unites readily with sulphur, with iodine if moisture be present, with most of the metals, and with all the non-metallic elements, hydrogen perhaps included. It forms salts with the acids, which are generally soluble and crystallizable.

The salts of *ferrous oxide*, for the most part, pass into ferric oxide salts, from their absorption of oxygen. Hence, they act in some cases as reducing agents; gold is completely reduced from its solutions by sulphate ot iron (*ferrous sulphate*). *Ferrous oxide* is influenced by the magnet.

Ferric oxide (*sesquioxide*, or *peroxide of iron*) (Fe_2O_3) occurs native as red hematite and specular iron ore. It is not influenced by the magnet. For its mode of preparation see under *Ferri Oxidum Hydratum.*

The native magnetic oxide of iron, or black oxide (the *loadstone*) is a heavy, black mineral, strongly attracting iron filings or steel. Its formula is Fe_3O_4. It is formed when iron is subjected to red heat and hammered, the black scales in smith shops being an example.

Iron forms 2 lines of salts, corresponding to the two oxides named—the *higher* (*ferric*) and the *lower* (*ferrous*) salts. *Ferrous salts* are usually produced when iron is acted upon by diluted acids under exclusion of atmospheric oxygen. Ferric salts require for their production in addition the intervention of a strong oxidizing agent, *e. g.*, nitric acid as well as an additional amount of the acid whose salt is desired. Hydrated ferrous salts are bluish-green, or, if anhydrous, whitish. The oxalate is an exception, being yellow. Ferric salts are, as a rule, dark colored; the normal ferric salts being yellow-brown or brown if hydrated, and whitish in anhydrous state; the basic ferric salts are brown or brown-red. Hydrochloric acid dissolves such ferric salts as refuse to dissolve in water.

Tests.—"FERROUS SALTS, in slightly acid solution, produce white precipitates with ferrocyanide of potassium. This precipitate rapidly absorbs oxygen from the air and turns blue. Ferrous salts are prone to absorb oxygen from the air and pass into *ferric salts*, therefore the precipitate is usually of a bluish-white color from the presence of ferric salts. If the solution of a ferrous salt be mixed with a solution of ferricyanide of potassium (red prussiate of potash), a deep blue precipitate at once results, insoluble in hydrochloric acid.

"FERRIC SALTS form blue precipitates with ferrocyanide of potassium (yellow prussiate of potash). If the solution of ferric salt is alkaline it must be rendered acid with acetic acid, and if it contain free mineral acid, add an excess of an alkaline acetate before applying the test. Ferric salts in neutral or moderately acid solution, strike a blood-red color with potassium sulphocyanide. This test is extremely delicate. An alkaline acetate in excess prevents the reaction." Tincture of galls or solutions of tannin produce with iron salts a black precipitate of tannate of iron.

Action, Medical Uses, and Dosage.—Iron in its metallic form has no action on the system; when swallowed in this state it becomes oxidized, apparently at the expense of the water in the stomach, for eructations take place, having a disagreeable chalybeate taste, and an odor of hydrogen. It was formerly usually given in the form of iron filings, in doses of from 5 to 10 grains. Now, when metallic iron is desired, reduced iron, in doses of from 1 to 5 grains, is usually selected. The proper method of obtaining iron filings for medicinal purposes, is to take a piece of soft, malleable, pure iron, and file it down; those obtained from the blacksmith's workshop, whether cleansed by the magnet or not, are impure and not fit for internal administration. Iron wire is generally sufficiently pure for the preparation of filings.

The various ferruginous preparations are termed chalybeate tonics; most of them also possess astringent properties. When taken for some time in small doses, they have the property of strengthening and sometimes accelerating the pulse, improving digestion, exciting the functions of the various organs, and augmenting the number of the red or coloring particles of the blood. When administered internally, iron probably enters the blood, as, after its exhibition, it has been detected in the urine, milk, and blood. Whether it increases the iron of the blood, is still an unsettled question, although it renders that fluid more florid. When iron has been taken to too great an extent, it produces more or less thirst, pain in the head or a sense of fullness, increased heat of the body, dizziness, laborious respiration, distension of the limbs, and other manifestations of vascular excitement. The indications for the use of the preparations of iron are "debility, feebleness, and inertia of the different organs of the body, atony (marked by a soft, lax, flabby condition of the solids), and defect of the red corpuscles of the blood—as where there is a general deficiency of this fluid (*anemia, oligæmia*) or a watery condition of it (*hydræmia, serous crasis, leucophlegmatic temperament*)" (P.).

These indications of Pareira, perhaps, can not be improved upon at the present time. Prof. Scudder regarded the deep, solid, blue discoloration of the mucous tissues and tongue, the coloring sometimes deepening to purplish, as the best indication for iron and its salts. Probably *anemia* is one of the best indications for iron, especially where the supply of red corpuscles is gradually and permanently diminished. If the loss is due to hemorrhages or other debilitating effects, and the digestive function is in good operation, food would probably be more beneficial than iron; but when the digestion and assimilation are impaired, iron becomes a most important remedy. Not only does it increase the number of red discs, but causes them, when pallid and shrunken, to become florid and plump; their oxygen-carrying powers are increased and better assimilation and nutrition is the result. On the other hand, in anemia, after the proper number and condition of red discs have been attained, its further administration becomes harmful, and, while iron is an important factor in the treatment of this condition, it must not be forgotten that it should constitute only a part of the treatment, and that proper food and hygienic measures should go hand in hand with its administration. Some contend for, and it has been the custom for years to give iron in enormous doses. Inasmuch as but a very little iron can be assimilated and elaborated in the blood, it would appear that the smaller doses would be less apt to provoke gastro-intestinal irritation, thus favoring their absorption. For this reason many prefer the small and even the minute dose, for all excess over that which is elaborated is discharged in the fæces, and undoubtedly large doses harm by provoking constipation and other effects not calculated to improve digestion and assimilation. Eclectic physicians, as a rule, have favored the small doses. When iron is not assimilated and when provocative of gastric disorders, it does harm, and this is particularly the case in certain *nervous disorders* and particularly in *epilepsy*. In nervous disorders, it should not be employed unless there is clearly an impoverished condition of the blood. Iron and its compounds are, of course, only palliative in structural diseases, as *cancer, interstitial nephritis, tuberculosis*, etc. *Active hemorrhage*, as a rule, contraindicates the use of iron. *Menorrhagia*, however, when profuse and watery, is benefited by it, as well as cases of scanty menses with a pale flow. In both instances the blood is lacking in red discs. *Passive hemorrhages*, on the contrary, are well treated with iron salts, particularly those made astringent by their union with the acidulous radical of the mineral acids. Iron is of value in *malarial disorders*, only in those cases in which the trouble has lasted long enough to induce a marked impoverishment of the blood itself. Ferrocyanide of iron, however, is thought by some to have some antidotal power over *malaria*. Iron is, therefore, applicable where the blood is poor in quality through a deficiency of its red corpuscles, and when associated with this there is marked debility, nervous depression, exhaustive discharges, and feeble digestion. Bearing in mind the indications, it is useful in the following disorders in which its salts have been efficiently employed: *Chorea*, *hypertrophy of the spleen*, *neuralgia*, *uterine debility*, *scrofula*, *leucorrhœa*, *rachitis*, *anemic* and *chlorotic conditions*, *chronic discharges from enfeebled and relaxed mucous tissues*, *chronic paralysis*, *atonic dyspepsia*, *albuminuria*, *desquamative nephritis*, *diabetes*, etc. The therapeutical influence of the several medicinal salts of iron are nearly the same, but where they become improved or qualified by union with other agents, reference will be made thereto under their respective captions. As a rule, in *erysipelas* the tincture of the chloride is preferred; the iodide is preferred as an alterative; the salicylate in fetid intestinal discharges; the phosphate in nervous depression; in excessive anemia the stronger preparations like the chloride, sulphate, and acid solution of iron; in ordinary debility the ammonio-citrate, citrate of iron and potassium, or the pyrophosphate, etc., are usually selected. When iron is in the form of ferrous oxide it is generally more active than where it is present as a ferric oxide. The preparations of iron are contraindicated in fever, acute inflammation, congestion of important organs, active hemorrhages, intestinal irritation, in persons subject to determinations of blood to the head, or affected with habitual constipation. The various salts and their doses will be given under their respective heads. The dose of reduced iron is from 1 to 5 grains; of iron filings, 1 to 10 grains.

Specific Indications and Uses.—Anemia, with debility, solid bluish color of the membranes and tongue; muscular relaxation.

Iron Salts.—FERRI SALICYLAS, *Ferrous salicylate*. Make solutions by dissolving ferrous sulphate (100 parts) in boiling water (200 parts), and of sodium carbonate (110 parts) in boiling water (200 parts). Filter the separate solutions, and, when cold, mix them together. Wash the resultant precipitate by decantation until all the sulphate of sodium is separated. Place the magma in a porcelain vessel and suspend the carbonate in water, and then dissolve it by the addition of salicylic acid, gently heating the mixture to facilitate solution. Filter, place on a water-bath, and dry by evaporation. This salt possesses properties more akin to those of salicylic acid than to iron. It is claimed to be the most efficient iron salt for hypoderdermatic use. Internally, it has been given in the *fetid diarrhœa of infants*, *acute rheumatism of the joints*, *aphthæ*, *erysipelas*, and *diphtheria*. It is regarded as a sedative, febrifuge, and diaphoretic.

FERRI ALBUMINAS, *Ferric albuminate*, *Albuminate of iron*.—Prof. C. Lewis Diehl's process for the preparation of this compound (see *Amer. Jour. Pharm.*, 1880, p. 177–190), is essentially as follows: Mix 10 troy ounces of egg albumen with its bulk of water, and make another solution of 125 minims of official ferric chloride solution diluted with 10 fluid ounces of water. Mix the solutions and filter. To the filtrate add 10 fluid ounces of saturated solution of chloride of sodium, put the resultant precipitate on a wet muslin strainer, and wash it with a mixture of sodium chloride in saturated aqueous solution (salt, 1 part, and water, 3 parts) until but a feeble iron reaction results in the filtrate. Drain the magma dry as nearly as possible by strong pressure, and complete the drying by atmospheric exposure. Finally, powder the product. This process gives a cinnamon-brown powder, which dissolves in water, especially if the latter be made slightly acid with hydrochloric acid. Owing to the fact that a little sodium chloride is present, the otherwise tasteless albuminate has a slight taste of common table salt. This salt is preferred by many on account of its rapid absorption, as a remedy for *anemia* and *chlorosis*. It may be administered alone or in combination in pill, but the best method is to administer a freshly prepared solution of 20 to 25 or 30 grains in water. *Gastric ulcer*, *irritative stomach disorders*, and the complications of the *menopause*, all in anemic persons, have been successfully treated with it.

FERRI ET MAGNESII CITRAS, *Iron and magnesium citrate*.—Dissolve freshly prepared ferric hydroxide, 2 ounces, in a moderately hot solution of citric acid, 3 ounces. Then saturate the foregoing liquid with magnesium carbonate. Filter, evaporate on a water-bath to a syrupy state, dry, and scale from glass. This salt forms transparent, soluble, greenish-yellow scales, having a faintly acid and feebly ferruginous taste. Alcohol and ether do not dissolve it. The dose ranges from 5 to 10 grains.

FERRI ET BISMUTHI CITRAS, *Iron and bismuth citrate*.—This compound is not a definite salt, and is prepared by adding ferric ammonio-citrate to citrate of bismuth dissolved in an ammoniacal aqueous solution. It has been used in *dyspeptic disorders*.

Ferri Tannas, *Ferric tannate, Tannate of iron.*—Ferric tannate may be produced as a bluish or greenish-black precipitate by treating cold ferric solutions with solution of tannin; also, by exposing to the atmosphere a mixture of tannin and a ferrous compound. The composition of tannate of iron varies somewhat according to the conditions observed in its preparation. Concentrated organic and the mineral acids decompose it, while boiling in water reduces it to a ferrous salt. Tannate of iron possesses tonic and astringent properties. It has been used with benefit in *chlorosis, amenorrhœa, chronic diarrhœa*, and in the *diarrhœa* accompanying some *febrile diseases*, etc. The dose is 2 or 3 grains made into pills, and gradually increased, so that in the course of a day 30 grains may be given. Tannate of iron does not stain the teeth.

Ferri Oxalas, *Ferrous oxalate* ($FeC_2O_4.2H_2O$).—Molecular weight: 179.58. The *U. S. P.* of 1870 prepared this salt by mixing solution of ferrous sulphate (2 ounces of salt) and oxalic acid (436 grains). "When a solution of ferric hydroxide in aqueous oxalic acid is exposed to the action of sunlight, carbon dioxide is evolved, and the ferrous salt is precipitated in fine lemon-colored glistening crystals (Roscoe and Schorlemmer). It is nearly tasteless, odorless and permanent, being but sparingly soluble in water (cold or hot), but dissolving in warm diluted sulphuric acid, and in cold hydrochloric acid. It is regarded by some (Hayem), as the best of the chalybeates; while others consider it a feeble agent. The dose is from 2 to 3 grains.

Ferri Benzoas, *Ferric benzoate* ($Fe_2[C_7H_5O_2]_66H_2O$).—Molecular Weight: 945.8. Precipitate ferric sulphate solution with a strong solution of either ammonium or sodium benzoate. Wash the precipitate on a filter with a small portion of cold water, press the salt, and dry it. This forms an almost tasteless brown-orange powder, which, when heated to 135° C. (275° F.), loses water and becomes brown The salt is decomposed at a higher heat, benzoic acid subliming. Alcohol and water partially dissolve it, the undissolved residue being basic ferric benzoate. This agent is employed where the action of benzoic acid with iron is desired. Dose, 3 to 5 grains.

Ferri Malas, *Ferrous malate, Extractum ferri pomatum.*—Digest for several days iron filings (3 or 4 per cent) with expressed sour-apple juice, at an elevated temperature. After reaction is complete, filter and evaporate. A variable amount of iron is present in this preparation which is quite popular in Europe. The *German Pharmacopœia* recognizes a *Tinctura ferri pomata* consisting of the blackish-green ferrous malate 1 part, made into solution with cinnamon water (containing alcohol $\frac{1}{10}$ part by weight) 9 parts. Ferrous malate prepared as above, is, of course, not a definite preparation. It is mildly chalybeate, and does not color the teeth. The dose of the salt is 4 or 5 grains; of the tincture from 20 to 60 drops.

Ferri Stearas, *Stearate of iron*—Is made by dissolving separately, in about three times their weight of water, 1 part of sulphate of iron, and 2 parts of hard soap, and then mixing the solutions; the resulting greenish precipitate is to be separated, dried, melted by a gentle heat, spread on cloth, and used like an ordinary plaster.

Ferri Succinas ($[C_4H_4O_4]_2Fe_2[OH]_2$), *Succinate of iron, Succinate of peroxide of iron.*—Take of succinate of ammonium, 1 ounce; solution of ferric sulphate, 2 ounces; distilled water, a sufficient quantity. Dilute the solution of tersulphate of iron with 8 ounces of the distilled water, and having dissolved the succinnate of ammonium in 4 ounces of the distilled water, warm the solutions and mix them together, continuing the heat moderately (not to exceed 76.6° C. [170° F.]), until the succinate of iron is completely precipitated. Wash the precipitate with distilled water until the washings will no longer give a precipitate with chloride of barium and aqua ammoniæ, and keep the hydrate under water in a stoppered bottle. The succinate of ammonium employed herein is prepared as follows: Take of aqua ammoniæ, sp. gr. 0.960, 1 fluid ounce; succinic acid, ½ fluid ounce. By the aid of a gentle heat dissolve the succinic acid in the ammonia water; then evaporate the solution sufficiently (very little), and set it aside to crystallize.

Prof. W. T. Wenzell (*Amer. Jour. Pharm.*, 1891, p. 272), has shown that the basic salt that is formed in the preparation of ferric succinate is insoluble in a cold solution of succinic acid or ammonium succinate, but is very soluble in ammonium citrate. He recommends *Liquor Ferri et Ammonii Succinatis*, holding in solution a compound of the composition, $Fe_2O.(C_4H_4O_4)_2.3(NH_4)_2.C_6H_5O_7$.

Freshly precipitated succinate of iron has a light rose-pink color, which, on drying the salt, becomes brick-red. In the moist state it is rapidly and completely dissolved (when dry with more difficulty), by hydrochloric acid, without effervescence, producing a yellow solution which yields a copious blue precipitate with ferrocyanide of potassium, but no precipitate with ferricyanide of potassium. It should be constantly kept in the moist state, and under water, otherwise it becomes hard and gritty. This salt of iron was introduced to the profession in 1867 (*Amer. Jour. Med. Sciences*, p. 51), by Dr. T. H. Buckler, of Baltimore, Md., as a remedy in *biliary calculi*. To dissolve the cholesterin of which gall-stones are chiefly composed, he recommends the use of chloroform in doses of a teaspoonful 3 times a day, after each meal, continuing its use for several days that these calculi may become dissolved. In cases where there are severe paroxysms of pain, the doses should be given every hour while the pain lasts. To control the fatty or cholesteric diathesis, and thus prevent the further formation of these calculi. the hydrated succinate of iron must be used continuously for 6 or 12 months, in doses of 10 or 12 grains after each meal, though if considerably more be taken it will produce no unpleasant results. This succinate will also be found useful for leucophlegmatic persons disposed to *obesity* or to *fatty degenerations* of vital structures.

Ammonii et Ferri Chloridum, *Ammonio-chloride of iron, Ammoniated iron, Ammonium chloratum ferratum, Ferrum ammoniatum.*—Mix ferric chloride (9 parts), with ammonium chloride (32 parts), and with constant stirring, evaporate to dryness. It forms a reddish-orange, crystalline powder, somewhat deliquescent, strongly saline, and styptic in taste. Water and diluted alcohol dissolve it entirely. It contains ferric chloride (Fe_2Cl_6) 7.25 per cent. It was formerly used in doses of from 4 to 12 grains, in *rickets, scrofula, amenorrhœa, epilepsy, anæmia,* and *general debility.* Its disagreeable taste is somewhat masked by syrup of liquorice. When prepared by sublimation, the yellow product is known as *Flores* (or *Ens*) *martis.*

FERRUM REDUCTUM (U. S. P.)—REDUCED IRON.

Synonyms: *Ferrum redactum, Iron by hydrogen, Iron reduced by hydrogen, Powder of iron, Quevenne's iron,* and *Ferri pulvis.*

Preparation.—Reduced iron is prepared by the action of hydrogen gas upon pure red-hot ferric oxide, the following reaction taking place: $Fe_2O_3+H_6=Fe_2+3H_2O$. The process is usually carried out by means of a combustion furnace in an iron reduction tube (a gun-barrel). After the reduction, the current of hydrogen must be maintained until the contents of the tube are cool. The reduced iron is then to be withdrawn and preserved in a dry, stoppered bottle. For details of the process, see *Br. Pharm.*, 1867. The *U. S. P.* directed the employment of subcarbonate of iron in the preparation of ferric oxide, and the purification of the hydrogen gas by allowing it to pass successively through diluted solution of subacetate of lead and milk of lime. The process of the *British Pharmacopœia* of 1867, directs the drying of the hydrogen. Care must also be taken that the sulphuric acid employed is free from arsenic. (For some valuable remarks on preparing iron by hydrogen, see paper by Prof. W. Procter, Jr., in *Amer. Jour. Pharm.*, Vol. XIX, p. 11, and Vol. XXVI, p. 217).

Description and Tests.—This preparation was introduced into medicine by Quevenne, as a substitute for porphyrized iron. When of a black color it should be rejected. It oxidizes rapidly in damp air, and hence should be kept in dry and well closed bottles. When placed on an anvil and struck with a hammer, it yields a bright, shining scale. The magnet strongly attracts it.

The *U. S. P.* describes reduced iron as follows: "A very fine, grayish-black, lusterless powder, without odor or taste; permanent in dry air. Insoluble in water or alcohol. When treated with diluted sulphuric acid, it causes the evolution of nearly odorless hydrogen gas, which should not affect paper moistened with lead acetate T.S. (absence of sulphide), and on applying a gentle heat, the iron should dissolve in the acid without leaving more than 1 per cent of residue. When ignited, in contact with air, it glows and is converted into black ferrosoferric oxide. If 1 Gm. of reduced iron be shaken with 5 Cc. of water, the liquid should not change the color of litmus paper. If 0.5 Gm. of reduced iron be added to 5 Cc. of arsenic-free hydrochloric acid, and the mixture be poured upon a filter while still effervescing, 1 Cc. of the clear filtrate should, after the addition of 2 Cc. of stannous chloride T.S. (see *List of Reagents*, Bettendorff's Test for Arsenic), together with a small piece of pure tin foil, and gentle heating, show no brown coloration within half an hour (limit of arsenic)"—(*U. S. P.*).

Estimation of Metallic Iron.—"Introduce 0.56 (0.559) Gm. of reduced iron into a glass-stoppered bottle, add 50 Cc. of mercuric chloride T.S., and heat the bottle, well stoppered, during one hour on a water-bath, frequently agitating. Then allow it to cool, dilute the contents with water to the volume of 100 Cc. and filter. To 10 Cc. of the filtrate, contained in a glass-stoppered bottle (having a capacity of about 100 Cc.), add 10 Cc. of diluted sulphuric acid, and subsequently decinormal potassium permanganate V.S., until a permanent red color is produced. The number of cubic centimeters of the volumetric solution required, when multiplied by 10, will indicate the percentage of metallic iron. To confirm the assay, decolorize the liquid by a few drops of alcohol, then add 1 Gm. of potassium iodide, and digest for half an hour at a temperature of 40° C. (104° F.). The cooled solution, mixed with a few drops of starch T.S., should require not less than 8 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color (each cubic centimeter of the volumetric solution indicating 10 per cent of metallic iron)"—(*U. S. P.*).

According to the *U. S. P.* assay directions, reduced iron should contain 80 per cent of metallic iron. Yet great variations have been observed in commercial specimens, reaching as low a limit as 18 per cent, due partly to incomplete reduction, partly to deterioration by oxidation in moist air. Mr. L. F. Kebler (*Amer.*

Jour. Pharm., 1896, p. 198), found 6 commercial specimens to vary in metallic iron from about 38 to 84 per cent. Among adulterations of reduced iron has occurred plumbago (graphite), the presence of which, however, can easily be recognized by being insoluble in diluted sulphuric acid.

Action, Medical Uses, and Dosage.—When this powder of iron is properly prepared, and not without, it forms a valuable tonic, and is considered to be superior to any other form of metallic iron for medicinal employment. It is without inky flavor, and is not liable to blacken the teeth. Its tendency to oxidize, and the unpleasant eructations of hydrogen gas to which it gives rise, render it objectionable. It may be used in *chlorosis*, *anemia*, and in all diseases in which there is a deficiency of red blood corpuscles. It may be used to antidote acute poisoning from the copper compounds. The dose is from 1 or 2 to 10 or 12 grains, in pill or bolus, but preferably suspended in water.

Related Preparation.—FERRUM PULVERATUM, *Pulverized iron*, known also as *Porphyrized iron* (*Ferrum porphyrisatum*), and *Alcoholized iron* (*Ferrum alcoholisatum*). This is a European product, liable to be confounded with reduced iron. It is prepared by mechanical processes (filing, etc.), from a good grade of cast iron, and thus necessarily contains carbon. It is denser than reduced iron, which it resembles, but it exhibits a luster (which the former lacks), and the hydrogen evolved from it has an unpleasant odor, that from reduced iron being inodorous. It refuses to burn when touched with a flame. It dissolves in hydrochloric and sulphuric acids, leaving a small amount of black, undissolved substance, and should exhibit but traces of hydrogen sulphide.

FICUS (U. S. P.)—FIG.

"The fleshy receptacle of *Ficus Carica*," Linné, "bearing fruit upon its inner surface"—(*U. S. P.*).

Nat. Ord.—Urticaceæ.

COMMON NAMES AND SYNONYMS: *Fici, Figs; Fructus caricæ, Ficus passa, Caricæ.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 228.

Botanical Source.—The fig tree is usually about 10 or 12 feet in height, but in warm latitudes exceeds this by 8 or 12 feet additional. The trunk is crooked, usually about ½ foot in diameter, with a grayish or grayish-brown bark, and round, green, or russet branches, covered with a coarse, short down. The leaves are alternate, large, rough on the upper side, coarsely downy beneath, cordate, 3 or 5-lobed, or almost entire, coarsely serrated, and petioled. The flowers are green, placed upon the inside of a turbinate, fleshy, closed receptacle, in the axils of the top leaves; male flowers, near the umbilicus, stamens 3, calyx 3-lobed; female flowers, calyx 5-lobed, ovary 1. The receptacle or fruit is solitary, axillary, more or less pear-shaped or almost round, succulent, sweet and pleasant to the taste. The seeds are small and numerous (L.—Wo.).

History and Chemical Composition.—The fig tree is believed to be a native of Persia and Asia Minor, but at present is raised in all mild latitudes. The structure of its fruit is peculiar; at first it is nothing more than a fleshy receptacle, but, as it advances to maturity, minute flowers form in a cavity which occupies the center of the mass and communicates outwardly by a small round aperture at the summit, and these flowers are succeeded by many small roundish seeds. While young, the fig abounds, like the trunk and branches, with a milky, aromatic, acrid juice, destitute of sweetness; but as it matures, sugar and mucilage are formed, and the acridity disappears. Its shape is generally turbinate or pear-shaped, of the size of an apricot, of various colors, some being whitish, others reddish or yellow, with a small pit or depression at the larger end, and of an agreeable, sweet, mucilaginous taste, and, when ripe, is sweet, high-flavored, and wholesome, but if eaten to excess, occasions flatus, intestinal pains, and looseness of the bowels. Figs are generally dried in the sun, sometimes in ovens, and are packed in baskets or drums. If left until perfectly ripe they dry on the trees. and are gathered as *dried figs*. The *Smyrna figs* are best. They are more or less flattened by pressure, and are covered with saccharine granules, which, in summer, contain numerous minute insects, are of a yellowish or brownish color, and rather translucent. The *Smyrna* or *Turkey figs* are pulpy and large, while a smaller, dried variety is known as *Greek figs*. Figs that retain their natural form somewhat, not having been compressed in packing, are known as *natural figs*, while another commercial variety is known as *pulled figs*, on account of having been rendered supple by kneading. They contain sugar of figs, 62.5; fatty matter, 0.9; extractive with chloride of calcium, 0.4; gum with phosphoric acid, 5.2; woody fiber, seeds, and water, 1.60 (P.). Starch is abundant in the unripe fig. The milky juice of the common fig tree (*Ficus Carica*) contains a digestive ferment (see *Amer. Jour. Pharm.*, 1880, p. 628, and 1887, p. 150).

Description.—Figs are officially described as follows: "Compressed, of irregular shape, fleshy, brownish, or yellowish, covered with an efflorescence of sugar; of a sweet, fruity odor, and a very sweet, mucilaginous taste. When softened in water, figs are pear-shaped, with a scar or short stalk at the base, and a small, scaly orifice at the apex; hollow internally; the inner surface covered with numerous yellowish, hard achenes"—(*U. S. P.*).

Action and Medical Uses.—Figs are nutritive, emollient, demulcent, and aperient, and are used in *costive habits*, and to flavor gruels, decoctions, etc. Roasted or boiled, they may be applied as a suppurative poultice to *gum-boils*, *buboes*, *carbuncles*, etc. A poultice of dried figs and milk will remove the stench of cancerous and fetid *ulcers* (Billroth).

Related Species.—*Mesembryanthemum crystallinum*, Linné (*Nat. Ord.*—Ficoideæ); *Diamond fig*, *Ice plant*. Europe. This plant has round-ovate leaves, and whitish or reddish blossoms. The plant is covered with vesicles, which glisten in the light, and is odorless and saline to the taste. Its juices contain salts, chiefly sodium and potassium compounds, oxalates being especially prominent. It has been used in Europe for various cystic disorders, chiefly *enuresis* and *dysuria*, *dropsy*, and as a demulcent in *pulmonic complaints*. Dose of expressed juice, ℥iv in a day. In South Europe it is gathered to furnish alkali for glass works (Hogg).

Mesembryanthemum edule, *Hottentot's fig.*—Sandy plain of Cape of Good Hope. Fruit edible and leaves used as pickles. Juice reputed useful externally in *burns*, and internally in *thrush* and *dysentery* (Hogg).

Mesembryanthemum tripolium, *Rose of Jericho*, *Flower of Crete.*—The natives of South Africa administer the water in which the fruit has lain to women to facilitate easy delivery in labor (Hogg).

FŒNICULUM (U. S. P.)—FENNEL.

"The fruit of *Fœniculum capillaceum*, Gilibert"—(*U. S. P.*) (*Fœniculum vulgare*, Gærtner; *Fœniculum officinale*, Allioni; *Anethum Fœniculum*, Linné; *Meum Fœniculum*, Sprengel).

Nat. Ord.—Umbelliferæ.

Common Names and Synonym: *Common fennel*, *Fennel fruits*, *Fennel seeds*, *Sweet fennel*, *Roman fennel*; *Semen fœniculi*.

Illustration: Bentley and Trimen, *Med. Plants*, 123.

Botanical Source and History.—Fœniculum capillaceum (*Fœniculum vulgare*), or *Common fennel*, is a biennial or perennial plant, with a whitish, tap-shaped root, the whole herb being smooth, and of a deep glaucous green. The stems are 3 or 4 feet high, erect, solid, round, striated, smooth, leafy, and copiously branched. The leaves are alternate and triply pinnate; the leaflets acute; thread-like, long, more or less drooping; the petioles with a broad, firm, sheathing base. The flowers are in large, terminal, very broad, flat umbels, with very numerous smooth, angular, rather stout rays; partial rays much more slender, short, and very unequal. Bracts or involucres are wanting. Calyx none. Styles very short, with large, ovate, pale-yellow base. The fruit is ovate, not quite 2 lines long, about a line in breadth, pale, bright brown and smooth; the ridges are sharp, with but little space between each; the lateral ones being rather the broadest; they are terminated by a permanent conical disk. The *Index Kewensis* considers the species *Fœniculum vulgare*, Miller, to represent those variously described as *F. capillaceum*, *F. officinale*, *F. dulce*, *F. Panmorium*, and others. Fennel is a native of Europe, growing wild upon sandy and chalky ground, and flowering in July (L.).

Fœniculum officinale, Mérat and De Lens, or *Large fennel*, is very much like the preceding, and the two are sometimes confounded; but its leaves are smaller, leaflets shorter, fruit paler, twice as heavy, much longer, somewhat curved, of a sweeter and more agreeable taste (L.). It inhabits the southern parts of Europe, and is naturalized in this country.

Fœniculum dulce, De Candolle, or *Sweet fennel*, and sometimes confounded with *F. capillaceum*, has somewhat the appearance of the latter, only it is not so large, seldom exceeding 12 inches in height, and the rays of its umbels being less in number by at least one-half; the fruit likewise varies considerably, being narrow, oblong, 3 lines long, pale, dull brown, smooth; ridges sharpish, with a space between each for a convex line, indicating the vittæ, the lateral ones rather the broadest. It inhabits the same countries as the preceding variety, and is cultivated for culinary purposes.

At one time these plants were placed in the genus *Anethum*, Linné, but De Candolle and Gærtner removed them to the present genus on account of the dissimilarity of the seed.

The seeds or mericarps of these plants possess nearly the same peculiar, agreeable spicy odor and flavor. There are 3 kinds in commerce, the *Sweet fennel*, which is also known as *Roman fennel*, and is of a pale green color; the brown fruits are known as *German* or *Saxon fennel*, while those from the uncultivated plants of France are called *Bitter* or *Wild fennel*. These species differ also in the length of their seeds, the Roman being the longest, and in the character of their striations. An East Indian variety, termed *Indian fennel*, is derived from *F. Panmorium*, De Candolle, now held to be a variety of *F. capillaceum* of Gilibert. The latter is not common in American markets. Water, at 100° C. (212° F.), takes up their properties by infusion, but not so thoroughly as alcohol. FENNEL ROOT is employed somewhat in Europe. Its taste and odor is that of fennel, though milder.

Description.—"Oblong, nearly cylindrical, slightly curved, from 4 to 8 Mm. ($\frac{1}{6}$ to $\frac{1}{3}$ inch) long, brownish or greenish-brown; readily separable into the 2 prominent mericarps, each with 5 light brown, obtuse ribs, 4 oil-tubes on the back, and 2 or 4 oil-tubes upon the flat face; odor and taste aromatic, anise-like"—(*U. S. P.*).

Chemical Composition.—The aromatic properties of these seeds are due to a volatile oil (see *Oleum Fœniculi*). The fruits also contain sugar, ash (about 7 per cent), and about 12 per cent of fixed oil; the root, sugar, starch, and volatile oil.

Action, Medical Uses, and Dosage.—Carminative, stimulant, galactagogue, diuretic, and diaphoretic. Used in *flatulent colic*, and as a corrigent of unpleasant medicines. May be used in *amenorrhœa* and in *suppressed lactation*. Dose of powdered seeds, from 10 to 30 grains; infusion (grs. xl. to aqua Oss), 1 teaspoonful (infants) to wineglassful (adults).

FŒNUM GRÆCUM.—FENUGREEK.

The seeds of *Trigonella fœnum græcum*, Linné.

Nat. Ord.—Leguminosæ,

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, Plate 71.

Botanical Source.—The source of this drug is the cultivated plant which grows to the height of 1 foot. Its stem is almost simple and bears trifoliate leaves. The leaf segments are articulated, obovate or oblong, wedge-shaped, and denticulate. The flowers are of a light yellow hue, sessile, and solitary. The fruit is a beaked, compressed, curved legume, containing about 15 or 16 seeds.

History and Description.—Fenugreek is an annual plant, native of west Asia, but is naturalized in Africa, south Europe, and India. It is cultivated for its seeds in Germany, France, Africa, and Asia. The seeds are small ($\frac{1}{8}$ inch long, $\frac{1}{8}$ inch broad, $\frac{1}{12}$ inch thick), hard, compressed, oblique, rhombic, having an oblique groove on each flattened surface. Externally they are pale brownish-yellow and yellow internally. Their odor is to some persons decidedly disagreeable, yet aromatic. The taste is mucilaginous, bitter, and nauseous. The powder is occasionally adulterated with starchy material, which may be detected with iodine since the seeds of fenugreek are free from starch. Powdered fenugreek is usually purchased by pharmacists, owing to the difficulty of powdering the seeds. Large quantities of powdered fenugreek are consumed in "condition powders," and as constituents of mixtures used in the treatment of hogs.

Chemical Composition.—Fenugreek seeds, as before stated, contain no starch; their constituents are a little tannin, mucilage, volatile and fixed oils, and a peculiar bitter body. Jahns found the alkaloid, *trigonelline* ($C_7H_7NO_2$) and *choline* ($C_5H_{15}NO_2$), the latter base being also a constituent of certain animal secretions (see *Fel Bovis*).

Action, Medical Uses, and Dosage.—The Greeks were acquainted with fenugreek, it being one of the important medicines employed by that people. The only property worth mentioning is its emolliency. A poultice (or plaster or ointment) of the powdered seeds, or a decoction, has been used on inflamed parts, and the latter has been used as a rectal and vaginal wash to soothe *irritation* or *inflammation;* it has likewise been used to allay irritation of the throat and breathing passages. The decoction is prepared from 1 ounce of the seeds and 1 pint of water. *Burns*, etc., may be dressed with its bland oil. The infusion or tincture may be used as a tonic to improve digestion. It relieves *uterine irritation* and acts as an emmenagogue. *Respiratory irritation* is thought to be relieved by its internal use, and a sack of the ground seeds is regarded as a valuable application in *chronic affections of the stomach, bowels*, and *liver* (Scudder, *Spec. Med.*).

FORMALDEHYDUM.—FORMALDEHYDE.

FORMULA: $H.COH = CH_2O$. MOLECULAR WEIGHT: 29.93.

SYNONYMS: *Formic aldehyde, Methyl aldehyde, Oxymethylene.*

Source, History, and Preparation.—Formaldehyde is a gas, and was discovered in 1867, by Von Hoffman, who obtained it by passing the vapor of a mixture of methylic alcohol and air over red-hot, finely-divided platinum. A useful modification of this process by Prof. O. Loew, is described in *Amer. Jour. Pharm.*, 1886, p. 440. Formaldehyde is of great importance in the physiology of vegetable life. According to Baeyer it is produced in plants from carbon dioxide and atmospheric moisture, by the action of the sun's rays in the presence of the chlorophyll of the leaves, thus: $CO_2 + H_2O = CH_2O + 2O$. It then becomes the mother-substance of carbohydrates, *e.g.*, starch and sugar (O. Loew's *formose*). Baeyer declares formaldehyde to be the natural protector of the tender portions of the plant against bacterial invasion.

Formaldehyde was introduced into medicine by Berlioz and Trillat in 1890. Its germicidal properties, however, had been established by Loew in 1888. The preparations that have been used in medicine, and for economic purposes, are 40 per cent solutions of this gas, forms of which are known by the trade names *formalin*, *formal*, etc. For disinfecting purposes, formaldehyde may be prepared conveniently by the lamp process introduced in recent years, whereby the gas is generated, as in Hoffmann's process, by incomplete combustion of methyl alcohol. In this connection it may be said that a simple and effective formaldehyde lamp is manufactured for physicians' use by Eli Lilly & Co., of Indianapolis (*Amer. Jour. Pharm.*, 1897, p. 223).

Description and Tests.—Solution of formaldehyde (40 per cent), as found in commerce, is a very volatile, pungent, peculiarly aromatic fluid. It has an acid reaction, due to the presence of formic and acetic acids, and a density of 1.070. It hardens animal tissues, and renders gelatin insoluble, even in hot water and alkaline media. It should be kept securely stoppered. Formaldehyde, when warmed with an ammoniacal silver solution, reduces silver, which deposits a mirror on the vessel. This property is shared by aldehydes in general. A distinctive reaction which affords a means for an easy quantitative determination of formaldehyde, consists in its combination with ammonia, hexamethyleneamine resulting. This compound, which is crystallizable, and has the composition $(CH_2)_6N_4$, yields formaldehyde again upon distillation with sulphuric acid. Of the various qualitative tests proposed for formaldehyde, *O. Hehner's Test* is sensitive and fairly characteristic. It is said to detect 1 part of formaldehyde in 200,000 parts of liquid, and is carried out as follows: To the liquid to be tested, *e.g.*, the distillate from a sample of milk, etc., add 1 or 2 drops of a weak solution of phenol (1 drop of phenol to 1 fluid ounce of water). Into a test-tube introduce a layer of concentrated, colorless sulphuric acid. Carefully pour the suspected liquid in a layer over the sulphuric acid so that but slight admixture takes place at the surface. If formaldehyde is present it will be indicated by a pink or vivid crimson zone. It should not give an orange-yellow or brown coloration (absence of acetic aldehyde in strong solution). *Lebbin's Test* is very delicate, detecting 1 part of formaldehyde in 10,000,000 parts of water. It is conducted as follows: To the liquid to be tested add a small quantity of a 50 per cent alkali solution (sodium or potassium hydroxide), followed by 1 drop of a 5 per cent solution of resorcin. Boil the mixture. If formaldehyde is present a crimson solution results. No yellow or brown coloration should result (absence of acetic aldehyde). For other tests, as well as an interesting resumé of the subject of formaldehyde, see F. C. J. Bird, *Pharm. Jour.*, 1896, Vol. III, p. 269, or *Amer. Jour. Pharm.*, 1896, p. 617.

Action, Economic and Medical Uses, and Dosage.—Formaldehyde is exceedingly volatile, and the vapor given off from its solutions is irritant to the nasal, faucial, and ocular mucous membranes. When concentrated it affects the cutaneous tissues similarly to phenol, leaving the surfaces roughish, white, and after a time insensitive. Its application to the skin does not produce pain. Of its internal effects but little is known. No ill effects followed the ingestion of a considerable amount of the 1 per cent solution (Rideal), and of the paraformaldehyde as large a dose as 90 grains has been administered as an intestinal antiseptic without harmful results. Owing to its action upon ammonia and ammonia bases, hydrogen sulphide, mercaptan, etc., forming odorless compounds, it has been used both in solution and vapor as an effective deodorant, the putrescent odor of decaying flesh being instantly removed by it. A very small quantity of the 10 per cent solution quickly deodorizes feces, brine, putrid meat, etc. Not only does it overcome odors, but it exhibits remarkable preservative powers. Thus the vapor from a pledget of cotton impregnated with 6 or 8 drops of the 40 per cent solution will preserve fish, meat, etc., for several days in a well covered vessel, even in hot weather. Neither odor nor taste is imparted to flesh thus preserved. Such organisms as give rise to lactic and butyric fermentation as well as other organisms producing secondary fermentation, are destroyed by formaldehyde. This can be accomplished with solutions (1 to 20,000 to 1 to 10,000) which are too weak to interfere with the development and growth of the *Saccharomyces cerevisiæ*, or with the production of alcohol.

Tables have been made for the use of formaldehyde solutions in various directions, which, however, are largely as yet experimental. The generation of formaldehyde gas for purposes of disinfection and sterilization has recently assumed importance. Specially constructed lamps have been devised for the direct generation of the vapor, either from methyl alcohol or from the polymerized formaldehyde or paraformaldehyde. Rooms, cellars, vaults, libraries, hospitals, schools, furniture, drapings, surgical dressings and appliances, etc., may be deodorized and disinfected by means of this gas. This substance has the advantage of being non-injurious to fabrics, metals, wood, and the common colors, except violet and light red. Prof. F. C. Robinson (*Jour. Amer. Public Health Assoc.*), states that at least a quart of methyl alcohol should be used in disinfecting an ordinary living-room. Several hours exposure to the gas destroyed the pathogenic bacteria of typhoid fever and diphtheria, even when folded between mattresses (Robinson). Koch's bacillus tuberculosis and other bacteria are said to be destroyed by it, the bacillus subtilis and bacillus mesenterica being possible exceptions. Roux, Trillat, Bosc, Wortmann, Stahl, Aronson, and Berlioz, are among the European experimenters who endorse formaldehyde as the leading disinfectant and antibacterial agent. In this country De Schweinitz and Kinyoun (*Public Health Reports*, Vol. XII, No. 5, 1897), have made extensive investigations. Test-cultures of bacteria have been the means used to demonstrate the active and destructive properties of the gas upon pathogenic micro-organisms. Kinyoun states it difficult to disinfect the interior of closed books, although it is claimed to be accomplished by others, and he questions its effectiveness in the interior of upholstered furniture, etc., unless very large amounts of the gas be employed. To accomplish results an exposure of at least one day is necessary, and the larger the quantity generated the better the results.

The various published reports would lead one to believe that the uses of formaldehyde for disinfecting purposes are practically without limit. This, however, proves not to be the case, for well-conducted experiments have satisfactorily demonstrated that it is of value chiefly as a surface disinfector, and is of doubtful utility when deep penetration is required (Doty, *N. Y. Med. Jour.*). It has also been shown that it acts best in a chamber from which the air has been exhausted. Park and Guerard of the New York City Health Department, who made comprehensive and thorough bacteriological tests with formaldehyde, endorse it only for surface disinfection, and state that the cost of disinfection by it is not greater than when sulphur is employed (see paper by G. L. Taylor, *Amer. Jour. Pharm.*, 1898, pp. 195–201).

The germicidal power of formaldehyde is undoubtedly due to its chemical combination with albuminous and nitrogenous materials, as bacteria are albuminoid in character and feed upon albuminoids. The penetrating properties of formaldehyde were demonstrated by Roux and Trillat by exposing to the gas liberated in a room gelatin-coated cubes of glass, whereby the gelatin was rendered insoluble even in hot water. Though destructive to micro-organisms, formaldehyde is innocuous to the higher forms of life. Unfortunately, it has practically no effect upon bedbugs, lice, roaches, etc. Formaldehyde has been advised as a preservative of vegetable solutions and botanical specimens. Unless in considerable amounts, it fails to prevent the formation of mold, as its action upon the low forms of vegetable life is not so pronounced as upon bacteria. Formaldehyde is used in photography for hardening purposes. It is declared superior to absolute alcohol, chromic acid, or corrosive sublimate for hardening histological materials, as the tissues become hard in three days, retain their cell forms, do not become brittle and stain well.

Formaldehyde has had a limited use in practical medicine. Painted upon the parts the solution gives relief and prevents extensive inflammation from the *bites of gnats, mosquitoes,* and *small animals.* Generated in a room, the vapor is said to drive away mosquitoes, flies, and similar pests. Washing the feet and wiping the inner soles of the shoes with the solution (2 per cent) is said to be effectual in fetid sweating of the feet—*bromidrosis.* Salter, of Guy's Hospital (*Brit. Med. Jour.*, 1896), praises it in *ringworm of the scalp.* It has been advised to sprinkle formaldehyde upon the clothing and bedding of those suffering from *typhoid fever,* while for the purpose of disinfecting the excreta it is regarded with much favor. In *diphtheria* it has been vaporized and the vapor inhaled so as to reach parts inaccessible by ordinary methods of making local applications. Its clinical value in this disease remains, however, to be established. Dr. Solis-Cohen (*Therap. Gaz.*, 1897), regards it as the best agent for the local treatment of the various forms—ulcerative, infiltrative, and vegetative—of *tuberculosis.* He first cleanses and cocainizes the parts, after which they are thoroughly rubbed with a 1 to 10 per cent solution of commercial formalin—practically equivalent to ½ to 4 per cent of formic aldehyde. Used in a properly constructed inhaler, the diluted vapor from formalin and water has been advised as useful in *catarrhal respiratory affections* and in the early stages of *pulmonary tuberculosis. Whooping-cough* appears to have been alleviated by the inspired vapor generated directly into the apartments of the patient or when used in the form of spray.

Solution of formaldehyde, in strength varying from 1 to 5 per cent, appears to give excellent results in *gonorrhœa*, particularly in *gonorrhœal vaginitis.* It may be used for other *infectious diseases of the genitalia.* Prof. De Smet (*Rev. Int. de Med. et de Chir.*) reports 60 cases of gonorrhœa in women, in which formaldehyde gave complete satisfaction. The vulva was first washed with a warm 1 per cent solution, after which, by means of a speculum, he poured a 2 to 5 per cent solution into the vagina and by means of a swab, worked this into the folds of the vagina, and about the cervix uteri. Where the infection had reached the cervico-uterine cavity a 2 per cent solution was injected into it. In cases where the cervix was ulcerated a formalin-impregnated (1 per cent) tampon of cotton or gauze was placed upon the sore and allowed to remain 2 or 3 hours. In severe cases of *fungous blennorrhagic endometritis* the parts were first curretted. The burning of the mucous membrane produced by the 5 per cent solution is but transitory.

Probably the greatest field for formaldehyde outside of its use as a general disinfectant, particularly in *zymotic diseases,* will be in surgical practice. The vaporization of *wounds* with it has already received the endorsement of practical men. For irrigation purposes in *accidental* or *surgical wounds* a 1 per cent solution has been found most practical. Prof. L. E. Russell (*Ec. Med. Jour.*, 1898, p. 296) recommends it for rendering aseptic instruments and diseased tissues. He used a full strength solution of formaldehyde to mop out the pelvic cavity after the removal of a large *tubo-ovarian abscess,* some of the contents of which had escaped into the surrounding parts. He formerly advised it half strength for washing out pus cavities, and for packing, directed gauze wrung out of equal parts of formaldehyde and sterilized water, but further use of it leads him to offer the following: "After a more extended use of formaldehyde, I am quite satisfied that it is a remedy that will require more care in its use upon open wounds or in the cavities mentioned than I had been led to believe from my former experience. To illustrate, I have been treating a *carcinoma* of the recurring form, following a breast excision, and I used the pure formaldehyde hypodermatically to check the infiltration of the carcinoma into the cutaneous and subcutaneous tissue. I found that by this method of treating the lesion it produced mummification of the skin and an escharotic condition of considerable importance. I therefore instructed the nurse to moisten pieces of gauze with the full strength formaldehyde and apply it to the skin-tissue over the region of the carcinoma. I found that, by the confinement of this gas by the gauze coverings, it produced an anæsthesia of the skin, and the formaldehyde infected the subcutaneous tissue to the depth of ¼ inch, making necrotic and completely mummifying the tissue beneath the moistened piece of gauze. I shall, therefore, have to correct the impression that I first formed of this new remedy in the treatment of *pus cavities* and *contaminated wounds;* that is to say, it must be used greatly diluted from that which I first suggested by way of experiment in the use of this new remedy for new conditions. I now believe that we have the ideal remedy to assail carcinomatous tissue where it would seem impossible to use the knife, or in those cases where the patient would not submit to more heroic treatment. I can readily see where this new remedy would be one of the best known in cases of *carcinoma uteri*, in those conditions where the discharge had become so offensive and where the invasion of the carcinoma had become so extensive that only palliative means could be resorted to. This remedy, in wounds of little contamination, should be used in the proportion of, say 1 to 20 or 50; and in those conditions where there seems to be a pyogenic membrane, it could be used in the proportion of 1 to 5 or 10. I do not know at this time just what results we should obtain in the use of this remedy if it be applied to diseased tissue and not protected by gauze, but allowed to evaporate. I am of the opinion that it could not even act as an escharotic; but if used with the gauze, covering the tissue and excluding the chances of evaporation, I believe it far excels any cancer plaster or escharotic ever presented to the profession, inasmuch as it anæsthetizes the tissue, stops almost instantly on its application the offensive odor, and penetrates deeply and speedily into the tissues exposed to its influence as above described. For irrigations and dressings with formaldehyde, I believe that the proper strength would be 1 ounce of the commercial strength to 1,000 of distilled water. Where the wound is infected, it can be increased to 5 volumes to 1,000 volumes of water" (*E. M. J.*, 1898, p. 435).

Altogether formaldehyde appears to have a promising future, and careful experimentation will determine its field of usefulness. Meanwhile, let us not expect too much of it, nor should we condemn it if it does not accomplish all that we are led to expect, until thorough tests have been given it at the hands of our physicians and surgeons.

Related Preparations.—PARAFORMALDEHYDE ($[CH_2]_3O_3$), *Paraformic aldehyde, Trioxymethylene.* This is a polymerized form of formaldehyde, and may be obtained by warming an aqueous solution of this gas, whereby part of it escapes and the remainder is transformed into a solid, crystalline substance, of the above composition, insoluble in water, alcohol, and ether. Its fusing point is 152° C. (305.6° F.), but it evolves vapors of formaldehyde at temperatures below 100° C. (212° F.). It may be used to disinfect bandages and other dressings.

TANNOFORM ($CH_2[C_{14}H_9O_9]_2$).—A condensation product of formaldehyde and tannic acid, occurring as a light reddish-white powder. At 230° C. (446° F.), it melts with decomposition. Water does not dissolve it, but it is soluble in alcohol, ammonia water, and such alkaline solutions as those of soda or sodium carbonate. Tannoform is tasteless and in doses of 15 grains is said to be non-irritant to mucous tissues. It is employed chiefly as a siccative antiseptic in the treatment of *hyperidrosis* and *bromidrosis*, in which it is said to excel salicylic acid. It is also reputed useful in *old wounds, ulcers, weeping eruptions, bed-sores, ozena, soft chancre*, and *diabetic pruritis*. Dr. Sziklai has recently employed this compound with marked success in *diarrhœa* and *intestinal catarrh* (see *Pharm. Centralh.*, 1897, p. 776). It may be used pure and in from 20 to 50 per cent triturations with starch or talcum. An ointment is sometimes preferred.

BROMALIN ($C_6H_{12}N_4.C_2H_5Br$), *Bromethyl-formin, Hexamethylenetetramine-bromethylate.*—White crystalline powder or colorless scales, readily soluble in water. When heated with sodium carbonate formaldehyde is evolved. In solution it has but little taste, but it is best administered in capsules or in mixtures sweetened with syrup of orange. Reputed in doses of 30 to 60 grains a good nerve sedative for women and children, particularly those suffering from *neurasthenia* or *epilepsy*. In the latter disease it is regarded as less powerful than potassium or sodium bromides, but is reputed to be free from their deleterious effects.

GLUTOL, *Formalin-gelatin*.—This odorless powder is reputed a non-irritative and non-toxic antiseptic dressing for *wounds*. For fresh wounds it should be applied freely soon after the injury, and allowed to remain on the parts until they are healed. In older injuries we are directed to change the primary dressing in 24 hours. It may be used upon *burns*, in *sinues*, etc.

FRANCISCEA.—MANACA.

The root and stem of *Franciscea uniflora*, Pohl (*Brunfelsia Hopeana*, Bentham).
Nat. Ord.—Solanaceæ.

COMMON NAMES: *Mercurio-vegetal, Manaca, Manacán, Camganiba, Geratacáca.*

Botanical Source.—This shrub is much branched, and is extremely variable as regards the shape of the leaves presenting obovate, oblong, obtuse, or acute ones on the same branch. The leaves are alternate, from 1 to 3 inches long, narrowing at the base, smooth, and, in texture, intermediate between coriaceous and membranaceous. The flowers are usually solitary, white, blue, or violet, and terminal on the smaller branches. Stamens 4, and ovary 2-celled, and surrounded by a fleshy ring. Stigma is coated with a glutinous, green, fungoid substance, serving to retain the pollen (De C.).

History and Description.—This plant is occasionally cultivated in greenhouses. It is a native of the American equatorial sections. Two kinds of manaca are found in commerce (*white* and *red*), being undoubtedly of different botanical origin. Jamaica dogwood (*Piscidia Erythrina*) is known in some sections of South America under the name *manaca*. The leaves are sometimes employed medicinally as well as the root and stems. As found in commerce, the drug consists of both stem and root, in pieces ranging from ¼ to 1 inch in thickness, and 6 to 8 inches in length. The wood is hard, tough, and yellowish-red in color, and surrounds a narrow pith; the bark, which closely adheres to the wood, is deep-brown in color and smooth when young, but in the older species the bark is rust-brown, rough, and scaly. It has a bitter taste, but no odor. Fluid extract of manaca was introduced to the American medical profession through the efforts of Parke, Davis & Co.

Chemical Composition.—The drug was analyzed by R. Lenardson, of Dorpat, 1884, who found the bark and the wood of root and stem to contain two proximate principles, one a weak, amorphous alkaloid of bitter taste, which (previously indicated by Prof. Dragendorff) he called *manacine;* the other fluorescent body is most probably identical with *gelsemic acid*. Manacine is toxic in large doses, soluble in water and alcohol, but insoluble in ether and chloroform. Its solutions are prone to decomposition, a brownish resin being formed. Brandl, in 1895, found that *manacine* decomposes in the presence of water at higher temperatures, a new compound, *manaceïne*, and a resinous and fluorescent substance resulting, the latter being identical with *æsculetin* (*Jahresb. der Pharm.*). A complete analysis of the drug, by John L. Erwin, is reported in the *Pharmacology of the Newer Materia Medica*, 1892, published under the auspices of Parke, Davis & Co.

Action, Medical Uses, and Dosage.—This agent was introduced as a remedy for *rheumatism*, the decoction having been so employed by the people living in the region of the Amazon. It was also reputed to be a remedy for syphilitic complaints, hence its name, *vegetable mercury*. Manaca has an influence over the nervous structures and the glands, being particularly diuretic. Painful sensations in the back and head are said to be the first effects of the decoction, which sensations are followed by profuse diaphoresis. Moderate doses induce emesis and purgation, greenish stools being passed. Gastro-intestinal effects from large doses may produce death, while its immoderate employment during pregnancy has occasioned abortion. Undoubtedly the agent acts in rheumatic complaints much like mezereum, guaiac, etc. It may be given in the subacute forms of rheumatism affecting the muscles and tendons, but is of little or no value in that form affecting the joints. Dull, heavy pains and soft skin, without fever, seem to be the symptoms indicating it. The dose of the fluid extract of manaca is from 10 to 60 minims.

FRAGARIA.—WOOD STRAWBERRY.

The fruit, leaves, and root of *Fragaria vesca*, Linné.

Nat. Ord.—Rosaceæ.

COMMON NAMES: *English strawberry, Alpine strawberry, Wood strawberry.*

Botanical Source.—Strawberry is a perennial plant, with a creeping, knotty root. The stems are trailing, with stolons often creeping several feet. The leaves are pubescent and trifoliate; the radical ones on long foot-stalks; the leaflets obovate-wedge form, coarsely serrate, and subsessile; the stipules lanceolate-oblong, cohering with the base of the petiole. The flowers, borne on scapes, are white, one or several; the peduncles are erect or nodding. The calyx is concave, deeply 5-cleft, with an equal number of alternate exterior segments or bracteoles; petals 5, and obcordate. Stamens numerous and small; styles deeply lateral; stigmas sessile and small; ovaries numerous. The receptacle in fruit is much enlarged and conical, becoming pulpy and scarlet, bearing the minute dry achenia scattered over its surface. In this species the achenia are superficial on the conical or hemispherical fruiting receptacle, not sunk in pits; in the *F. Virginiana* the achenia are imbedded in the deep pits of the receptacle (W.—G.).

History and Chemical Composition.—This is a European species, presenting exhaustless varieties, which are extensively cultivated, flowering from April to May, and ripening its fruit in May and June. The *F. Virginiana*, Ehrhart, or wild strawberry; *F. canadensis*, or mountain strawberry; *F. grandiflora*, or pine-apple strawberry, and the other varieties possess similar properties. The fruit of all the varieties is highly fragrant and delicious, the cultivated varieties frequently being very large. The fruit contains about equal parts of citric and malic acids, sugar, mucilage, pectin, water, peculiar volatile aroma, woody fiber, and pericarps. The root contains a glucosid called *fragariamarin*, not easily soluble in water, alcohol, or ether. Upon hydrolysis with acids it splits into sugar and *fragarin*, a red amorphous substance (C. E. Sohn, *Dictionary of Active Principles of Plants*, 1894).

Action, Medical Uses, and Dosage.—The fruit, used very freely, has been highly spoken of in *calculous disorders*, likewise in *gout*, and the juice will dissolve the hard concretion called "*tartar*," which forms on the teeth, and without injuring them. With some, strawberries disagree, causing disordered digestion, and frequently a rash-like eruption on the surface. The grains or seed-like pericarps are indigestible, and sometimes cause irritation of the bowels. Strawberry-juice, or the syrup, added to water, forms a refreshing and useful drink for febrile patients; care being taken that the grains are removed by filtering or expressing the juice or syrup through a piece of muslin. Strawberries eaten with cream are, as a rule, injurious to dyspeptics. The leaves are slightly astringent. and have been used, in infusion, in *diarrhœa*, *dysentery*, and *intestinal debility;* the roots are diuretic, and have been beneficially used, in infusion, in *dysuria*, *gonorrhœa*, etc. The leaves of the wild strawberry, gathered after the ripening of the fruit, and dried in the sun, or in heated pans, afford a greenish and slightly astringent infusion, like that of the Chinese tea, with similar diaphoretic, diuretic, and excitant properties.

FRANGULA (U. S. P.)—FRANGULA.

"The bark of *Rhamnus Frangula*," Linné, "collected at least one year before being used"—(*U. S. P.*) (*Frangula Alnus*, Miller; *Frangula vulgaris*, Reichenbach).

Nat. Ord.—Rhamneæ.

COMMON NAMES: *Buckthorn* (*U. S. P.*, 1880), *Alder buckthorn*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 65.

Botanical Source.—The alder buckthorn is a smooth shrub growing to the height of from 10 to 15 feet. Its leaves are oval, obovate, or elliptic, broad, obtuse, and entire, or scarcely sinuate. The under surface is faintly downy. The flowers, which are greenish and hermaphrodite, are borne in the axils to the number of 2, 3, and 5. All the floral parts are 5 in number. The fruit is a nearly black (first red) berry, about the size of the common pea, and contains rounded-angular (2 or 3) seeds.

History and Description.—This shrub grows in wet situations throughout Europe, Siberian Asia, and the North African coast. It is improperly called *Black alder* in some parts of Europe. The bark is collected from the larger branches and the young tree-trunks in the spring of the year. It should not be used until at least a year old. The *U. S. P.* describes the drug as follows: "Quilled, about 1 Mm. ($\frac{1}{25}$ inch) thick; outer surface grayish-brown, or blackish-brown, with numerous small, whitish, transversely-elongated lenticles; inner surface smooth, pale brownish-yellow; fracture in the outer layer short, of a purplish tint; in the inner layer fibrous and pale yellow; when masticated, coloring the saliva yellow; nearly inodorous; taste sweetish and bitter"—(*U. S. P.*). It yields with cold water a yellow, and with hot water, a brown colored infusion.

Chemical Composition.—This bark contains tannin, purgative extractive matter, an amorphous, non-purgative bitter, and an odorous, volatile principle not yet isolated. The chief constituent, however, is the glucosid *frangulin* (Casselmann), or *rhamnoxathin* ($C_{21}H_{20}O_9$, Schwabe, and confirmed by T. E. Thorpe and A. K. Miller, 1892). Carbon disulphide extracts it from the bark, and the principle may be recrystallized from ether or alcohol (see *Proc. Amer. Pharm. Assoc.*, 1892). This body forms silky-lustrous, lemon-yellow crystals. Yellow needles are obtained by sublimation. Frangulin dyes cotton, wool, and silk. It is inodorous and tasteless, soluble in alkaline solutions (with a vivid purple color), but little soluble in ether or cold alcohol, and not at all soluble in water. Upon hydrolysis with dilute acids it yields *emodin* ($C_{15}H_{10}O_5$) (or *tri-oxy-methyl-anthra quinone*) and *rhamnose* (frangula sugar) ($C_6H_{12}O_5$) (*Proc. Amer. Pharm. Assoc.*, 1892, p. 719). Impure frangulin was named *avornin* by Kubly, in 1866. *Emodin* from this source was identified as such by Liebermann and Waldstein, in 1876, the name *frangulic acid* (*frangulinic acid*) having been previously affixed to it by Faust, in 1869. Both principles (frangulin and emodin) are only to be found in aged bark (*Amer. Jour. Pharm.*, 1888, p. 515).

Action, Medical Uses, and Dosage.—Nausea, colicky pain, and violent emeto-catharsis are the effects produced by fresh frangula bark. When dried, however, it loses some of its acridity, and then acts as a purgative only. Both the alvine and renal discharges are colored dark-yellow by it. Narcotic symptoms have been produced by eating the berries and seeds, the toxic effects having been probably produced by the prussic acid contained in the seeds. The decoction has been administered in *dropsies*, and the same preparation as well as an ointment of the recent bark, has been used for the cure of *itch*. Its chief value, however, is as a laxative and cathartic, being quite popular for these effects with the Germans. It resembles senna and rhubarb in action, according to some, being harsher, but is regarded by Squibb as milder than either. It is a remedy for *chronic constipation*, from 1 to 3 doses of 20 minims of the fluid extract being administered in water in the course of a day. If desirable to evacuate the bowels at once, a fluid drachm may be given at bedtime. An elixir (4 parts of fluid extract to 12 parts of elixir of orange) may be given in from 1 to 2 fluid drachm doses; of the decoction ($\frac{1}{2}$ ounce of bark to $\frac{1}{2}$ pint of water) the dose is a tablespoonful.

FRANKENIA.—YERBA REUMA.

The plant *Frankenia grandifolia.*
Nat. Ord.—Frankeniaceæ.
COMMON NAME: *Yerba reuma.*

Botanical Source and Chemical Composition.—This plant constitutes what is now known throughout the eastern United States as the drug "*Yerba reuma.*" This is a small shrubby plant, with a prostrate, much-branched stem, about 6 inches long. It is a native of California, and is found in abundance in sandy localities near the coast. The leaves are opposite, entire, obovate, tapering at the base, and ending in a small, mucronate point. The flowers are sessile, between the forks of the branches, small, and of a bright-pink color. The calyx is tubular, 5-angled, 5-toothed, and hairy externally. The petals are 5, slightly longer than the calyx, and attenuated to slender claws. The stamens are 6 or 7, and about the length of the petals. The pistil consists of a 1-celled, many-seeded ovary, and 3 slender styles, united for about two-thirds of the way, and stigmatose along the inner surface. This plant is very salty to the taste, having an astringent after-taste. It contains tannin to the amount of about 6 per cent, as seen from an analysis of the plant by Carl Jungk in *Pharmacology of the Newer Materia Medica*, 1892. Yerba reuma was introduced by Dr. J. H. Bundy, of Colusa, Cal., through an article contributed to *New Preparations*, Vol. II, p. 2, 1878. Parke, Davis & Co., under whose auspices that journal was published, brought the fluid extract before the medical profession, and are entitled to the credit of its introduction (see *New Preparations*, 1877–78, and 1879).

Action, Medical Uses, and Dosage.—This plant has been recommended as a mild astringent, having a favorable action upon diseased mucous membranes, and is serviceable in *diarrhœa*, *dysentery*, *vaginal leucorrhœa*, *gonorrhœa*, *gleet*, and *catarrh*. The dose of the fluid extract is from 5 to 25 minims; when diluted with water, it may be applied locally by injection or spray.

FRASERA.—AMERICAN COLUMBO.

The root of *Frasera Carolinensis*, Walter (*Frasera Walteri*, Michaux).

Nat. Ord.—Gentianaceæ.

COMMON NAME: *American columbo.*

Botanical Source.—American columbo is an indigenous plant, with a triennial, long, fusiform, horizontal, rugose, and yellow root, and a smooth, erect, solid, cylindrical, or subquadrangular, succulent, dark-purple stem, from 4 to 9 feet in height, 1 or 2 inches in diameter at the base. The leaves are smooth, oblong-lanceolate, acutish, sessile, feather-veined, entire or wavy, subcarnose, from 3 to 12 inches, by 1 to 3, in whorls of 4 to 6, rarely opposite, decreasing in size as they approach the summit. The flowers are tetramerous, 1¼ inches in diameter, yellowish-white or greenish-yellow, with brown-purple dots, a large purple pit or gland near the base bordered by a strong and even fringe. They are borne in terminal, compound, pyramidal, leafy, or bracteated, verticillate panicles. The calyx is deeply 4-parted, the segments being acute, and shorter than the oblong, obtusish petals; corolla wheel-shaped. Stamens 4, shorter than the corolla, and alternating with its segments; filaments subulate, anthers large, oblong, versatile, and yellow; ovary oblong, attenuated into a short style; stigma bifid and distinct; capsule or fruit oval, compressed, acuminated with the persistent style, and yellowish; and the seeds few, large, imbricated, elliptical, and wing-margined (L.—G.—W.).

History and Description.—This plant grows west of the Alleghanies, on the borders of lakes and in the rich soils in the middle and southern states, bearing flowers in June and July, which, however, together with the stems, are not developed until the third year, the root-leaves only, in the meantime, being visible. The part used is the root, which should be gathered in October and November of the second year of the plant, or in March and April of its third year; it is hard, fusiform, and wrinkled; as met with in commerce it is in dried, transverse slices, with a brown epidermis slightly tinged with red, yellow cortex, and a spongy, straw-colored center. Its taste is bitter, and its properties are taken up by wine, water, or alcohol of sp. gr. 0.935. The root of this plant has been mistaken for that of calumba, but it may be determined from the latter, which, on account of the starch it contains, strikes a blue color with tincture of iodine, while the American plant undergoes no change of color. Sulphate of iron produces a blackish-green color with an aqueous solution of the American root, but does not affect the foreign root. Tincture of galls gives a dirty-gray precipitate when added to the tincture of calumba. A transverse section of calumba shows a series of concentric circles, with diverging lines, which are absent in the American root. Sliced frasera root has been sold as *American gentian*.

Chemical Composition.—American columbo has been investigated by Douglass (*Amer. Jour. Pharm.*, Vol. VI, p. 177), W. R. Higginbotham (*Ibid.*, 1862, p. 23), and F. W. Thomas (*Ibid.*, 1868, p. 309). These authors found it to contain gum, tannic acid, resin, saccharine, fatty and waxy matter, pectic acid, yellow coloring matter, and bitter extractive. Mr. Thomas obtained also some yellow acicular crystals, and established the absence of albumen, starch, and berberine. In 1873 Mr. G W. Kennedy showed its chemical relationship to gentian-root by isolating from Frasera Walteri, by a somewhat complicated process, two principles found in gentian, viz., the bitter and neutral *gentiopicrin* ($C_{20}H_{30}O_{12}$), soluble in alcohol and water, insoluble in ether, and *gentisic acid* ($C_{14}H_{10}O_5$), yellow crystals of acid reaction, insoluble in water, soluble in alcohol and ether.

John U. Lloyd, in 1880 (*Amer. Jour. Pharm.*, p. 71), published a simple process for the preparation of the yellow crystals, specimens of which were submitted to Mr. Kennedy (1881), and identified as the gentisic acid obtained by him. Additionally, it was found that ferric chloride produced a deep-green coloration with these crystals. Prof. E. L. Patch, reviewing these results experimentally (see *Proc. Amer. Pharm. Assoc.*, 1881, p. 457), concluded that Kennedy's gentisin from Frasera Walteri, was not identical with gentisin obtainable from gentian root, but was in all probability a new substance. In 1891 (*Pharm. Rundschau*, p. 143), H. Trimble and J. U. Lloyd resolved the yellow crystals into two substances differing chiefly in their melting points.

Action, Medical Uses, and Dosage.—The recent root of American columbo is said to cause purging and vomiting; but when dried it is a simple tonic, which may be used wherever mild tonics are indicated. Dr. Scudder (*Spec. Med.*, 139), regards it a "stimulant to the circulation," and states that it "will doubtless exert the same influence upon all the vegetative functions." *Obstinate constipation* has been relieved by its persistent use. Dose of the powder, from 20 to 60 grains; of the infusion, from 1 to 4 fluid ounces, 3 or 4 times a day; of specific frasera, 5 to 30 drops, well diluted, every 2 to 6 hours.

FRAXINUS.—ASH.

The bark of *Fraxinus sambucifolia*, Lamarck, and *Fraxinus americana*, Linné (*Fraxinus acuminata*, Lamarck; *Fraxinus Epiptera*, Michaux; *Fraxinus alba*, Marsh), and other species of *Fraxinus*.

Nat. Ord.—Oleaceæ.

Common Names: I. *Black ash, Elder-leaved ash;* II. *White ash.*

Botanical Source and History.—Fraxinus sambucifolia is a tree which attains the height of from 40 to 70 feet. The trunk is covered with a bark of a darker hue than that of the white ash, less deeply furrowed, and from 1 to 2 feet in diameter. The wood is purplish, very tough and elastic, and less durable than the white ash. The leaves are from 9 to 16 inches in length, composed of about 7 leaflets, which are sessile, ovate-lanceolate, serrate, rugose, shining, round-oblique at the base, smooth above, and red-downy on the veins beneath. Calyx and corolla both wanting; buds of a deep-blue color. The samara is elliptical-oblong, and very obtuse at both ends. This species grows in swamps and moist woods in the northern states and Canada, blossoming in May. The young saplings are much employed in making hoops, and the mature trunks for baskets. The leaves when bruised exhale the odor of elder (W.—G.).

Fraxinus americana of Linnæus, or the *Fraxinus acuminata* of Lamarck, is a large forest tree, which grows from 50 to 80 feet high; it often rises more than 40 feet without a branch, and then expands into a regular summit of an equal additional height. The trunk is covered with a gray, furrowed, and cracked bark, and the branchlets are smooth and greenish-gray. The leaves are a foot or more in length, opposite, pinnate, consisting of about 7 leaflets, which are petiolate, oblong, shining, acuminate, entire or slightly toothed, and glaucous beneath. The flowers are whitish-green, disposed in loose panicles, the fertile ones with a calyx, the barren ones without. Corolla wanting. The calyx is small and 4-cleft, the buds of a rust color. The samara is spatulate-linear, obtuse, with a long narrowed base. The white ash is chiefly confined to the northern states and Canada, growing in rich woods, and blooming in April and May. Its wood is light, elastic, and durable, furnishing a most excellent timber for carriage-frames, bars, hand-spikes, agricultural implements, etc. (W.—G.).

Chemical Composition.—There are several species of this tree, all of which possess medicinal virtues, probably of a similar character. The bark is the part used, the properties of which are extracted by water. John M. Bradford, in 1882, found the bark of Fraxinus americana to contain, among other substances, an acid and neutral resin, sugar, and gum, and a minute quantity of volatile oil. H. M. Edwards obtained in minute quantity a bitter alkaloid, which he believed to constitute the active principle of the drug. The presence of tannin has also been observed (*Amer. Jour. Pharm.*, 1882, p. 282, and 1883, pp. 117 and 370).

Action, Medical Uses, and Dosage.—Tonic and astringent. An extract of the black ash used as a plaster is very valuable in *salt-rheum* and other *cutaneous diseases*. The infusion may be used internally as a tonic, and for all purposes where a combination of astringency with tonic influence is indicated. The white ash is also cathartic, and has been found beneficial in some cases of *constipation*, and also in *dropsical affections*. It may be used in the form of infusion or in bitters. The bark in white wine, is said to be efficient in curing *ague-cake*, or enlarged spleen. The seeds are said to prevent *obesity*. Dose of specific fraxinus, 10 to 60 drops.

Related Species.—*Fraxinus excelsior*, Linné, *Common European ash.* This species is indigenous to Europe, and is cultivated in this country for shade and ornament. A variety is known, *F. excelsior*, var. *pendula*, or *Weeping ash.* The bark of F. excelsior had considerable reputation at one time in Europe as a remedy for *intermittents*. The leaves, which are laxative and purgative, according to the quantity taken, have been used successfully in *gouty* and *arthritic rheumatic complaints*. The leaves contain considerable amounts of calcium malate, tannin, some free malic acid, mannit, dextrose, inosit, gum, quercitrin, and a very aromatic volatile oil, of the composition $C_{10}H_{20}O_2$ (Gintl and Reinitzer, *Amer. Jour. Pharm.*, 1883, p. 371). The bark contains a glucosid, bitter and crystalline, known as *fraxin* or *paviin* (see *Æsculus Hippocastanum*). Its formula is $C_{16}H_{18}O_{10}$. Diluted acids split it into *glucose* ($C_6H_{12}O_6$) and *fraxetin* ($C_{10}H_8O_5$). The fruit contains mucilage, tannin, an acrid, resinous body, a bitter substance, and a green oil of a disagreeable odor (Keller). *Fraxinit* (Mouchon's), is a purgative, extract-like body, and is in all probability *mannit* (Husemann and Hilger, *Pflanzenstoffe*, 1884).

Fraxinus viridis, Michaux; *Green ash.*—Used in Mexico. Leaves and bark tonic; root diuretic.

FUCUS VESICULOSUS.—BLADDER-WRACK.

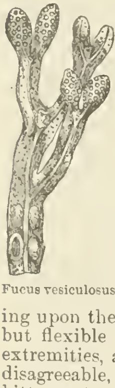
The marine plant, *Fucus vesiculosus*, Linné.

Nat. Ord.—Fucoideæ.

COMMON NAMES: *Bladder-wrack*, *Sea-wrack*, *Cut-weed*, *Kelp-ware*, *Black-tang*, *Quercus marina*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 304.

Fig. 115.



Fucus vesiculosus.

Botanical Source.—Fucus vesiculosus is a perennial sea-weed. Its root is a hard, flattish disk. The frond or thallus ranges from a few inches to 4 feet in length, and from 2 lines to an inch in width, is flat, furnished with a midrib throughout its length, occasionally twisted in a spiral manner, repeatedly dichotomous, the angles of the dichotomy acute, except when a solitary vesicle happens to be placed there; the sterile branches are obtuse, and often notched at the extremity. The air-vessels vary from the size of a pea to a hazel-nut, and are placed in pairs, situated at irregular intervals in different parts of the frond; sometimes 2 or 3 pairs are arranged next to each other; and they are rarely altogether wanting. The receptacles are terminal, compressed, mostly ovate or elliptical, about ½ inch long, but varying from nearly spherical to linear-lanceolate, and from ¼ inch to nearly 2 inches long; they are mostly in pairs, but are sometimes solitary, and occasionally forked. They are filled with a clear, tasteless mucus. The whole frond is proliferous in a remarkable degree in cases of injury, throwing out numerous new shoots from the injured part (L.)

History, Description, and Chemical Composition.—*Fucus vesiculosus*, *Sea-wrack*, or *Bladder fucus*, is a common marine plant, growing upon the sea shores of Europe and America. Its substance is rather thick, but flexible and tough, with a dark, olivaceous, glossy-green color, paler at the extremities, and becoming black by drying. Its odor is strong, its taste quite disagreeable, and it contains cellulose, mucilage, mannit, odorous oil, coloring and bitter matters, sodium, and potassium combined with iodine, bromine, and chlorine. The ash of this plant amounts to about 3 per cent; of this ash, iodine constitutes about 0.7 per cent. On account of the iodine contained in its charcoal, known as *Vegetable ethiops* (*Æthiops vegetabilis*), it has been found beneficial in scrofulous enlargements of the glands; the plant being incinerated in a covered crucible, and the charcoal given in doses of from 10 grains to 2 drachms. When burned in the open air it yields *kelp;* it is used as a manure in some places, and is also fed to cattle during the winter. Probably other species of Fucus have analogous virtues.

Action, Medical Uses, and Dosage.—M. Duchesne Duparc recommended an infusion of this plant or the extract in pill form for the purpose of lessening *obesity.* It requires to be used 3 or 4 weeks before this effect will be observed, which is preceded with an augmented secretion of urine, presenting a black pellicle upon its surface upon standing for a short time. Others have confirmed this statement regarding it. Later experiments by numerous good observers do not seem to indicate that sea-wrack has any power as a fat-reducer, but that the reduction which takes place in some instances is undoubtedly due to the dietary measures which are a part of the treatment. It is thought, however, to have some power of toning muscular fiber, and has been suggested to prevent *fatty degeneration of the heart.* It influences the kidneys, lessening renal congestion and resultant irritation, and is therefore of service in *acute desquamative nephritis;* it also relieves *cystic irritation* and *chronic inflammation of the bladder.* Take of specific fucus from 5 to 20 drops, every 3 hours. It was at one time recommended to remove *deposits* and *tissue hypertrophies*, as well as *benign* and *malignant tumors.* It is a remedy which deserves a careful investigation, especially in regard to its influence over waste and nutrition. It acts quite powerfully upon the glandular system as an alterative, and is recommended for *menstrual derangements* with weak, flabby uterine walls. Dose, of specific fucus, 5 to 30 drops.

Related Species.—The following plants are thought to possess similar properties, the first mentioned having been allowed by the *French Codex* as a substitute for bladder-wrack: *Fucus siliquosus*, Linné (*Cystoseira siliquosa*, Agardh; *Halidrys siliquosa*, Lyngbye), *Fucus serratus*, Linné, *Fucus natans*, Linné (*Sargassum bacciferrum*, Agardh), *Fucus nodosus*, Linné (*Fucodium nodosum*, Agardh). *Fucus digitatus* contains much more iodine (7 or 8 times as much) than bladder-wrack.

FUMARIA.—FUMITORY.

The plant *Fumaria officinalis* Linné.

Nat. Ord.—Fumariaceæ.

COMMON NAME: *Fumitory.*

ILLUSTRATION: Johnson's *Med. Bot. of N. A.*, Fig. 104.

Botanical Source.—This is an annual glaucous plant, with a sub-erect, much-branched, spreading, leafy, angular stem, growing from 10 to 15 inches high. The leaves are mostly alternate, bipinnate, or tripinnate; the leaflets are wedge-shaped, cut into flat, lanceolate segments. The flowers are small, flesh-colored, tipped with crimson, nodding, the pedicles becoming erect in fruit. The racemes are opposite to the leaves, stalked, erect, many-flowered, and rather lax. The bracts are lanceolate, acute, and not half the length of the pedicles, especially when in fruit. Petals 4, unequal, one of them with a short, rounded spur at the base. The calyx is colored, toothed, and deciduous. The fruit or nut is ovoid or globose, indehiscent, emarginate, 1-seeded, and valveless, and the seed crestless (W.—G.).

History and Description.—This plant is found growing in cultivated soils in Europe and this country, bearing red flowers in June and July. The leaves, which are generally used, have no odor, but a bitterish taste, and, when fresh, furnish a large quantity of an aqueous, bitter, and inodorous juice, which possesses their therapeutical properties, and which is soluble in water, wine, or alcohol.

Chemical Composition.—The most prominent constituents of fumitory are an alkaloid *fumarine, fumaric acid*, and considerable amounts of inorganic matter, especially potassium salts. Upon incineration, Fumaria officinalis leaves about 8 per cent of potassium carbonate (Husemann and Hilger, *Pflanzenstoffe*, 1884). *Fumarine* was probably first obtained by Peschier, in 1829, and later investigated by Hannon (1852), Preuss (1866), and others. It forms colorless, monoclinic prisms, bitter in solution, soluble in alcohol, amyl alcohol, chloroform, benzene, and carbon disulphide, little soluble in water, insoluble in ether. It is closely related to the corydaline of Adermann (see *Amer. Jour. Pharm.*, 1890, p. 396). According to Reichwald (*Jahresb. der Pharm.*, 1889, p. 406), it has the formula $C_{21}H_{19}NO_4$. More recently Battandier observed its occurrence in a papaveraceous plant, *Glaucium corniculatum*, var. *phœniceum*, and a variety of other plants (*Ibid.*, 1892, p. 139). *Fumaric acid* ($C_2H_2[COOH]_2=C_4H_4O_4$), occurs in a number of different plants, *e. g.*, in Iceland moss, and was first isolated from fumitory, in 1833, by Winckler. Fumaric acid is obtained by heating malic acid ($C_4H_6O_5$) with water acidulated with sulphuric acid, to 180° C. (356° F.), whereby 1 molecule of water is split off. It occurs in colorless prisms or stellate scales, is somewhat soluble in cold, more soluble in hot water, to which it imparts an acid reaction; is also soluble in alcohol and ether, and forms salts with bases mostly soluble in water, but all of which are insoluble in absolute alcohol (Husemann and Hilger).

Action, Medical Uses, and Dosage.—It is a weak tonic, very much used in *cutaneous diseases*, in *jaundice*, *obstructions of the abdominal viscera*, *scurvy*, and in cases of *debility of the digestive organs* (E. and V.). It is also slightly diaphoretic and aperient. Dose of the infusion, a wineglassful every 2 or 3 hours; of the expressed juice, ½ wineglassful, 2 or 3 times a day. Two ounces of the tops and flowers infused in 3 pints of Madeira wine, and taken twice a day in doses of from 2 to 4 fluid ounces, will strengthen the stomach and improve the appetite.

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